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Geotechnical
Environmental and
Water Resources
Engineering

Site Characterization Work Plan

MacDermid Incorporated

526 Huntingdon Avenue
Waterbury, Connecticut
USEPA ID# CTD001164599
Permit # DEP/HWM/CS-151-001

Submitted to:

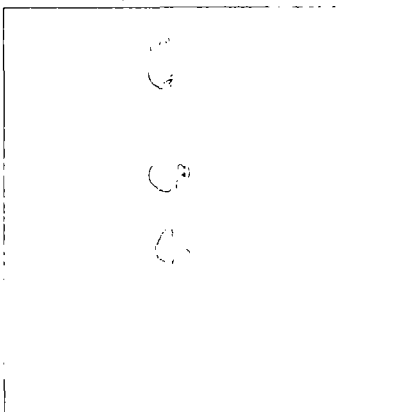
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April 2008

Project # 073290-*-1000



Frederick W. Johnson

LETTER OF TRANSMITTAL

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To:	Carolyn Casey	Date:	April 22, 2008
	United States Department of Environmental Protection – Region 1	Project No.	073290-1000
	1 Congress Street, Suite 1100	Re:	Site Characterization Work Plan –
	Boston, MA 02144-2023		MacDermid Incorporated

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No.	Type	Description
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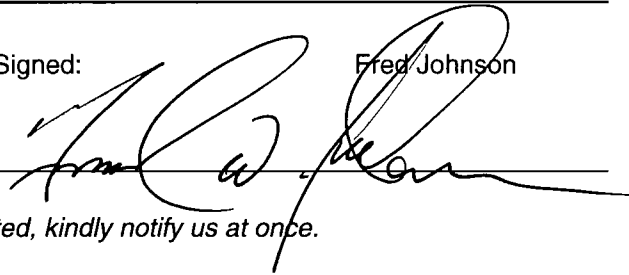
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Message:

Copy to: John Cordani – MacDermid Inc.
Dave Rinquist – CTDEP
Pete Long – The Environmental
Quality Company

Signed:

Fred Johnson



If enclosures are not as noted, kindly notify us at once.



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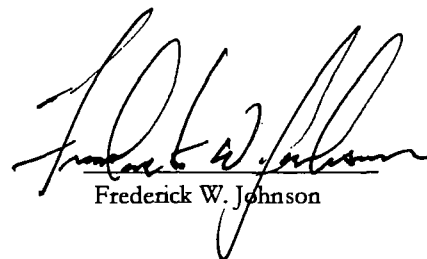
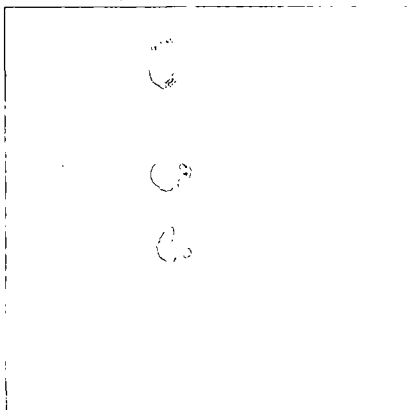
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- 3 Conceptual Site Model
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- B HASP
- C AOC B – UST Closure Report (Electronic Only)
- D AOC E2 – WWTS Closure Plan & DEP Acceptance Letter (Electronic Only)
- E AOC K1 – RCRA Closure Summary for Former Hazardous Waste (Electronic Only)
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1. Scope of Work

1.1 Introduction

This section presents a detailed work plan which describes field investigations proposed to address data gaps identified in the December 29, 2007 Scope of Work and Schedule. The Scope of Work and schedule provided a description of each area of environmental concern (AOC) and identified potential release pathways. The history of release, past investigations and remediation to date are also summarized. The assessment of these past data provides the basis of the identified data gaps. The Quality Assurance Project Plan (QAPP) (Appendix A) provides information relevant to the field investigations regarding Quality Assurance / Quality Control (QA/QC) procedures and standard operating procedures (SOPs). All field investigations will be conducted in accordance with procedures described in the QAPP.

This Scope of Work is primarily intended to assess if releases have occurred from the various site AOC's. The data collected will significantly enhance the current site conceptual model and facilitate future work of each AOC. Generally, the new data will determine if the AOC is in one of the following categories:

- 1) Enough current and historical data to effectively document closure.
- 2) Confirm a release and plan for additional assessment.
- 3) Confirm a release and plan for interim remedial measures.

In the case of category 1, the Environmental Protection Agency (EPA) and the Connecticut Department of Environmental Protection (CTDEP) will be provided with a complete data set and engineering rationale to support a closure decision. In the case of categories 2 or 3, a complete work plan for further investigation or interim remedial measures will be prepared.

Table 1 and Table 2 presents the general rationale and proposed sampling and analysis for the borings and monitoring well locations. A site location map is included as Figure 1 and proposed sample locations are shown on Figure 2.

1.2 Site-Wide Groundwater Monitoring

There are 18 wells located on the property that are currently sampled quarterly. These wells are as follows, MW-101, MW-102, MW-103, MW-105, MW-106, MW-109, MW-110, MW-111, MW-112, MW-113, MW-114, MW-115, MW-116S, MW-116D, MW-117S, MW-117D, MW-118S, and MW-118. The location of these wells is indicated on figure 1.

The condition of the wells has recently been assessed. Based on this assessment, the well installations are being repaired. The repairs consist of resetting the well covers in new concrete pads. All wells will be clearly marked with a well identification number. The well locations will be surveyed after the repairs are completed.

Seven additional groundwater monitoring wells (MW-115D, MW-119, MW-126, MW-127, SB-48/MW-128, MW-129, and MW-130) will be installed and monitored as part of the site wide groundwater monitoring program and to address specific areas of concern (AOCs). The wells will be installed using a Geoprobe-drill rig, a conventional hollow-stem auger rig or sonic drill rig. Monitoring well MW-115D will be drilled to the top of bedrock (approximately 60 feet). Monitoring wells MW-119, MW-126, MW-127, SB-48/MW-128, MW-129 and MW-130 will be installed to intersect the groundwater table (approximately 35 feet). The wells will be constructed of 2-inch diameter Schedule 40 poly-vinyl chloride (PVC) 0.010-inch machine slotted screen and riser pipe. The annular space between the well screen and borehole wall will be backfilled with sand and a bentonite clay seal above the sand pack. The remaining annular space will be filled to grade with cement/bentonite grout. The monitoring well will be fitted with a flush-mounted curb box secured with cement.

The newly installed wells will be developed by bailing a minimum of three well casing volumes from each well until the water is visibly clear or the turbidity of the water has been noticeably reduced.

Purging and sampling of the existing and new monitoring wells will be conducted using the low-flow procedures as described in the QAPP. The wells will be purged and sampled at rates that minimize or eliminate significant draw down. Water quality will be monitored for pH, temperature, specific conductivity, oxidation-reduction potential (Eh), dissolved oxygen, and turbidity. These parameters will be recorded at five-minute intervals to determine well stability. Stability is achieved when pH is within 0.1 standard unit, temperature is within 0.5°C, Eh is within 10% and specific conductivity is within 10% for three consecutive readings.

When stability is attained, samples will be collected directly from the pump tubing. Groundwater samples will be placed directly into pre-cleaned and appropriately preserved sample containers provided by TestAmerica Connecticut (Shelton CT). Test America is a Connecticut certified Laboratory.

Initially groundwater samples will be analyzed for Volatile Organic Compounds (VOCs), Target Analyte List (TAL) metals, Cyanide, and Tin. Groundwater samples taken from MW-115, MW-115 D, MW-118s, MW-117s, MW-119, MW-126 and MW-129 will also be analyzed for Semivolatile Organic Compounds (SVOCs), and Samples taken from MW-101 MW-102, MW-103, MW-104 and MW-105 will also be analyzed for Extractable Total Petroleum Hydrocarbons (ETPH).

Results from the events will be compared to the Connecticut Remedial Standard Regulations (CT RSRs) See SOP number SA-002 located in Appendix A of the Quality Assurance Project Plan.

After the installation of the new well discussed above, two quarterly groundwater monitoring will be conducted and evaluated for overall effectiveness to assess stabilization under the environmental indicators. Proposed changes in the groundwater monitoring program will be presented to the CTDEP and EPA for approval under the Stewardship permit.

1.3 Site-Wide Soil Sampling

Soil samples will be collected continuously to the water table from each boring. Drilling equipment (rods and macro-core sampler) will be decontaminated in the vicinity of the sampling rig between each sample location.

Two soil samples will be selected for chemical analysis from select borings based on AOC and field observations. In cases where two samples will be taken, the first sample will be collected from the upper four foot using a hand auger during utility clearance activities. This shallow sample will evaluate subsurface soil conditions for potential direct human contact exposure pathways at the site. A second sample will be collected at the depth interval indicating the greatest degree of contamination to evaluate the magnitude of the observed impacts at each boring. The greatest degree of contamination will be identified by field screening of the borings with a photo-ionization detector (PID), and by visual and olfactory observations. If impacts are observed, the boring will be advanced approximately 5 feet beyond observed visual impacts for the purpose of vertical delineation to a maximum depth of 40 feet. If no impacts are observed at a particular on-site boring location, the boring will terminate at approximately 10 feet below the observed groundwater table and a soil sample will be obtained for analysis at the apparent groundwater table.

1.4 Resource Conservation and Recovery Act (RCRA)

The Stewardship Permit RCRA closure requirements address closure of five hazardous waste management areas and require that these units be closed in accordance with the approved Closure Plan. The approved Closure Plan is dated December 5, 2002 and is titled "*Closure Plan Modification for MacDermid Incorporated Hazardous Waste Storage Areas*" with revisions dated January 24, 2003 and March 7, 2003. The five RCRA units include the following:

- Main Container Storage Area. This area is part of AOC-G: East Aurora Street Warehouse. Containers of spent copper etchant were formerly stored in this area.
- Quality Control Area. This area is also a part of AOC-G: East Aurora Street Warehouse. Containers of spent copper etchant were formerly stored in this area.

- **Copper Etchant Waste Storage Tanks.** This area is part of AOC-E3: Bulk Copper Spent Etchant Unloading and Storage Area. The etchant storage area consists of three 7,500 gallon and one 3,500 gallons former above-ground storage tanks.
- **Copper Etchant Recycling Area.** This area is part of AOC-E4: Spent Copper Etchant Recycling Area. The Closure Plan addresses closure of this entire area; however, it also indicates that the regulated portion of this area includes two stainless steel reactor tanks. MacDermid will close this entire area in accordance with the Closure Plan.
- **Metal Hydroxide/Sulfide Sludge Storage Area.** This area is part of AOC-E2: Wastewater Treatment Unit. The area subject to the Closure Plan contains two 3,000 gallons sludge holding tanks and a sludge roll-off storage container.

The Closure Plan requires decontamination or removal of all impacted equipment and structures in the above areas, and soil sampling in the event visual evidence of migration pathways indicates that potential contamination has migrated to soil underlying each unit. Any contaminated soil detected will be addressed through the RCRA corrective action requirements, not the RCRA closure requirements in the Stewardship Permit. After the structures and equipment are properly closed, MacDermid will provide a certification of closure to CTDEP and EPA prepared by an independent licensed professional engineer.

1.5 Scoping-Level Ecological Risk Assessment

Consistent with the CT DEP Site Characterization Guidance Document, the results of a Phase II investigation will be used to perform a Scoping-Level Ecological Risk Assessment (ERA) (CT DEP, 2007). A Scoping-Level ERA's purpose is to determine the need for an evaluation of potential ecological risks due to site related activities. The process encompasses the following steps:

- **Review of Existing Data:** This involves review of information collected during the Phase I and II investigations including site history, land/water uses and classification, known/suspected chemical releases, and potentially affected media.
- **Review of Ecological Information:** This includes identification of ecological resources/habitat in the vicinity of the site, determination of species potentially present including threatened or endangered species of concern, and site visit observations.
- **Scoping Level Decision:** Have there been releases and are ecological resources present or in the vicinity of the site?

GEI Consultants will address the Scoping Level ERA through correspondence with the U.S. Fish and Wildlife Service (USFWS), CT DEP, and other regulatory agencies. In addition, site visits will be conducted with the following objectives:

- Identify the fish and wildlife resources, habitats, cover type, wetland and stream classifications at the site and in the vicinity.
- Identify the fauna expected within each cover type and aquatic habitat.
- Document observations of stress to the site soils and vegetation.
- Describe the value of habitat to expected fauna.
- Describe the value of the fish and wildlife resources to humans.
- Determine whether contaminants are present that potentially could affect the expected fish and wildlife resources.
- Recommend whether a Screening-Level ERA is warranted.

The information will be summarized in a report. In addition, a decision table or flow diagram will be used to assist in making a decision as to whether a Screening-Level ERA is warranted (Table 4). This decision tool will use the information regarding the site outlined above to determine whether an ERA is required by following a logical progression of determining type and extent of contamination as well as type of ecological resources, similar to the process used by New York Department of Conservation (NYSDEC, 2001).

1.6 Site-Wide Stormwater Monitoring

Stormwater from the entire site drains into five (5) outfalls, two of which are located on Gear Street and three of which are located on East Aurora Street. Outfalls 001 and 005, located on Gear Street, discharge to the Waterbury storm drain system which directs the flow to Steele Brook (which subsequently flows into the Naugatuck River). Outfalls 002, 003, and 004, located on East Aurora Street, discharge to the Waterbury storm drain system which directs the flow to the Naugatuck River. See Figure 2 for outfall locations.

Outfall 001 receives runoff from the majority of the site, including the former outdoor flammable material storage area, the former empty container outside storage area, the former bulk chemical loading/unloading area, the former waste lagoons, the former industrial wastewater treatment system area, the former acid tank farm, and the former bulk spent copper etchant unloading, storage, and recycling areas. According to the site Stormwater Pollution Prevention Plan (last updated in 2002), this outfall is to be sampled annually to comply with the requirements of the General Permit for the Discharge of Stormwater Associated with Industrial Activity. In practice, Outfalls 002 and 003 (which collect runoff from roof drains and two of the paved areas on the eastern portion of the site) have also been sampled on an annual basis.

Stormwater will continue to be monitored in accordance with the requirements of the General Permit and the Stormwater Pollution Prevention Plan (SWPPP). MacDermid is in the process of updating the existing SWPPP to reflect the current operational status of the site.

1.7 AOC A, North Parcel

1.7.1 Description of Unit Function, Components and Materials Managed

Prior to 1978/1979, no industrial activities are known to have occurred at AOC-A. AOC-A was used to receive potentially contaminated soil from AOC-E1. AOC-A is the area used by MacDermid in 1978/1979, erroneously reportedly in a TRC report (TRC, 1993) to have been used for the disposal of approximately 1,000 cubic yards of metal hydroxide (MOH) sludge and potentially contaminated soil excavated from the closed waste lagoons (AOC-E1). However, there is no information available to suggest that any sludge was co-located with the soil at AOC-A and there is no information to characterize the sludge managed at the former AOC E-1 lagoon as a listed F006 sludge. See section 1.11 for more information regarding historical lagoons.

MacDermid personnel reported to GZA GeoEnvironmental, Inc. of Vernon, Connecticut (GZA, 1995) that the TRC report was incorrect. MOH sludge from AOC-E1 was not disposed of in AOC-A, but was disposed of off-site. In the **Part B Permit Application** this area was also annotated as a "soil disposal area" as opposed to caustic sludge disposal.

This AOC measures approximately 50 feet wide by 95 feet long (TRC, 1993), and is located approximately 400 feet north of the Huntingdon Avenue facility on a 30.350 acre parcel owned by MacDermid. There are several small piles of unknown origin surrounding the asphalt cap that are overgrown with brush.

The material removed from AOC-E1 was reportedly (IPC, 1986) mixed with sand and gravel to increase its load bearing characteristics. Following its placement in AOC-A in 1978/1979, it was covered with clean fill. The existing layer of clean fill (depth varies) was covered with nine (9) inches of processed aggregate and three (3) inches of bituminous concrete (i.e., asphalt) in 1986 (IPC, 1986). The asphalt cap was observed on April 4, 2001 to contain several cracks and was littered with broken glass bottles and plastic cups. The remnants of a small campfire were also observed on the northwestern portion of the asphalt cap.

1.7.2 Potential Release Pathways

- **Surface Water and Sediments** - Minor possibility of erosion from piles and damaged portions of the asphalt cap.
- **Soils** - Exposed piles, Disposal area is capped, but in disrepair. Potential for casual trespassers.
- **Groundwater** - Metals and cyanide have been detected in downgradient wells.
- **Air** - None

1.7.3 History of Releases, Investigations and Remediation

No releases have been documented on AOC-A or the surrounding area. The area, however, was used to dispose of potentially contaminated soil from the former lagoon area. The contents of the surrounding piles are unknown. There are documented references that the soils managed in this area may contain some residual sludge from the former lagoon.

Two wells are currently located near AOC-A, MW-101 (formerly known as MAC-6) and MW-102. MW-101 (formerly known as MAC-5) is located upgradient on the north edge of AOC-A. MW-102 is located approximately 230 feet south (downgradient) of MW-101, on the south edge of AOC-A.

In April 1986, the industrial Pollution Control (IPC) corporation of Westport, Connecticut, installed the two (2) groundwater monitoring wells in the area of AOC A. Monitoring well MW 101 is a bedrock well. Boring logs indicate that bedrock was encountered at a depth of 3.5 feet below grade. This 2-inch-diameter PVC well was set at a depth on 36 feet below grade (bg) with 10 feet of screen. Monitoring well MW-102, which is located approximately 230 feet south of MW-101, is a 2-inch diameter PVC monitoring well. At this location, refusal was encountered at a depth of 31.75 feet below grade. Monitoring well MW-102 was set at a depth of 31.75 feet bg with 10 feet of screen. The monitoring wells are equipped with two 2-foot high stand pipe and locking caps. Groundwater samples taken have indicated concentrations of metal and cyanide in the wells.

1.7.4 Data Gaps and Work Plan

- Condition of the asphalt cap and cover materials needs to be assessed.

Visually assess condition of asphalt cap and drill borings (SB-3 & SB-4) to assess the thickness of the asphalt cap, gravel sub-base, and fill characteristics based on visual logging of the boring.

- Type of material stored under the cap warrants characterization to confirm if sludge is commingled with the soil.
- Assess the volume of the materials stored.

Two samples from boring SB-3 and SB-4 will be collected and analyzed to characterize material under cap. In addition, if waste material is encountered in borings SB-1, SB-2, SB-5, or SB-6, samples will be taken and analyzed to characterize the material. Borings will be drilled using a direct push drill rig to below the depth of any apparent contamination or waste material. Following the collection of subsurface soil samples, each subsurface soil boring will be abandoned by grouting the boring from the bottom of the boring to the top.

Soil samples will be selected for chemical analysis from each boring based on greatest degree of contamination. The greatest degree of contamination will be identified by field screening of the borings with a photoionization detector (PID) and by visual observations.

Each sample will be analyzed for VOCs, RSR-15 metals, Cyanide, Tin and ETPH. Synthetic Precipitate Leaching Procedure (SPLP) analysis will be done for metals on a contingent basis if required, to determine compliance with the GB PMC for other parameters. Two samples (SB-3 & SB-4) of the material under the cap will also be analyzed for waste disposal acceptance parameters. Waste characterization Criteria is determined by the disposal facility, but typically includes analysis for Flashpoint, Reactivity, ETPH, TCLP Metals, Polychlorinated Biphenyls (PCBs)(mass), VOCs (mass) and pH.

Borings SB-1, SB-2, SB-5, or SB -6 will be collected at what appears to be the limit of the disposal area to estimate horizontal extent and SB-3 and SB-4 will be collected from the center of the disposal area to estimate depth. Additional borings will be drilled to confirm the disposal area limits if borings SB-1, SB-2, SB-5, or SB -6 appear to be in the disposal area based on field observations. The vertical extent of contamination will be assessed in the field per methods described in section 1.3. Based on the sampling and analyzed results, the volume of fill material will be estimated.

- Assess the effectiveness of the current groundwater monitoring system.

Review most recent groundwater sampling events to assess effectiveness of MW-101 and MW-102. If current wells are found to be ineffective, additional well installation may be necessary.

- Assess the nature and extent of the surrounding soil piles.

Characterize material in surrounding piles by collecting a sample from borings on each pile (proposed SB-7 to SB-15). Depending on the number and size of the piles additional samples may be analyzed. Three borings will be made in each pile using a hand auger, and one soil sample will be selected for chemical analysis from each pile. The sample selected will be the one with greatest degree of contamination. The greatest degree of contamination is based on field screening using a PID and by visual observations. Each sample will be analyzed for VOCs, RSR-15 metals, Cyanide, Tin and ETPH. One sample will also be analyzed for waste disposal acceptance parameters

- Evaluate the need for securing the area of AOC-A from potential trespassers.

The condition of the cap and characterization of underlying material will determine if additional measures are necessary to prevent contact with or disturbances of the material disposed.

- Presence of Total Petroleum Hydrocarbons in the groundwater.

During the next and subsequent sampling rounds, the groundwater samples collected from MW-101 and MW-102 will be analyzed for ETPH in addition to the groundwater monitoring parameters specified in section 1.2, site-wide groundwater monitoring.

1.8 AOC-B Underground Storage Tank

1.8.1 Description of Unit Function, Components and Materials Managed

This AOC was comprised of one (1) 4,000 gallon underground storage tank (UST) located on the northern side of the Huntington Avenue building. The additional USTs known to have been located or still in use at this facility, have been identified as AOC-F and AOC-J. The UST located at this AOC was originally installed in 1959 and was removed in September 2000. This steel tank is cathodically protected and the cathodic protection system is tested on an annual basis to ensure the required negative voltage between the UST and the copper sulfate electrode is being maintained. This UST is used to store No. 2 fuel oil.

1.8.2 Potential Release Pathways

- **Surface Water and Sediments**

None, unless there was a catastrophic release from the tank.

- **Soils**

Leakage from the tank could impact surrounding soils.

- **Groundwater**

Groundwater could be impacted by a release of oil.

- **Air**

No. 2 fuel oil is not a very volatile compound. However a significant subsurface release could release odors to a down gradient building.

1.8.3 History of Releases, Investigations and Remediation

No documented releases to the surrounding environment are known to exist for this AOC. Investigations performed in the area of AOC-B are summarized in the following reports.

GZA's Soil and Groundwater Investigations (1995); In 1995 GZA installed monitoring well MW-103 (formerly (GZ-2). During installation of the well, a soil sample was collected and was taken at a depth of 10-12 feet.

The sample was submitted for analysis for TCLP extractable metals and VOC's by EPA method 8260. Results of the sample indicated that no PMC standards were exceeded.

HRP's Groundwater Sampling Event (2001); Groundwater samples were taken from monitoring well MW-103 in March 1995 and February 2001. Samples taken were analyzed for dissolved metals, total and amenable cyanide, fluoride, and VOCs by EPA method 8260. Sampling results indicate that no standards were exceeded.

Monitoring well MW-103 appears to be located 130 feet hydraulically downgradient of AOC-B. Boring logs for monitoring well MW-103 indicated no visual or olfactory signs of potentially contaminated soil.

1.8.4 Data Gaps

- The condition and operation records of the tank need to be reviewed.
- Condition of the soil surrounding the UST may warrant assessment depending upon the outcome of the operating assessment.
- Additional groundwater monitoring may be warranted to assess if a release has occurred.

The surrounding soils will be assessed by collecting a sample from a boring placed downgradient in the vicinity of the UST (SB-16).

The boring will be installed using a Geoprobe-direct push drill rig. The soil sample with the greatest degree of contamination, based on field screening and observations will be selected for chemical analysis. If obvious contamination is encountered during the drilling event it may be necessary to install additional borings and/or groundwater monitoring wells to assess the extent of the release. Alternatively, an interim measure to remove the tank and remediate the surrounding soil will be considered

The sample will be analyzed for VOCs, SVOCs and ETPH. Following the collection of subsurface soil samples, each subsurface soil boring will be abandoned by grouting the boring from the bottom of the boring to the ground surface.

Currently one groundwater monitoring well included in the quarterly groundwater sampling (MW-103) is located downgradient from AOC C.

GEI reviewed a letter, dated November 18, 2002, regarding the removal of the UST. According to the letter, LEA preformed the oversight, sampling and reporting of the UST. Six soil samples were taken from the tank grave and results show no indication a release had occurred. The tank grave assessment was done consistent with current CT DEP UST closure guidance. A copy of the letter is included in Appendix C.

1.9 AOC-C Dry Chemical Silos

1.9.1 Description of Unit Function, Components and Materials Managed

This AOC is located on the northeastern side of the Huntingdon Avenue building and consists of four upright 10,000-gallon steel silos located on a raised concrete pad. These totally enclosed (i.e., top, sides, and bottom) silos were formerly used for the storage of dry sodium carbonate (two types, light and dense, CAS 497-19-8), sodium metasilicate (CAS 6834-92-0), and anhydrous sodium hydroxide (CAS 1310-73-0). The silos were empty; they were environmentally cleaned in May 2002 by LEA/LEA-Cianci, Inc. MacDermid had the silos removed during February 2008.

1.9.2 Potential Release Pathways

- **Surface Water and Sediments**

These silos are empty. Any residual spillage from their past use would have fallen on the pavement in dry form, washed away and degraded.

- **Soils**

The area is paved and any spillage of dry material would have been contained on the surface.

- **Groundwater**

There is minimal potential for residual groundwater impacts from these dry materials.

- **Air**

Because the silos are empty and clean, this pathway no longer exists.

1.9.3 History of Releases, Investigations and Remediation

No documented releases to the surrounding environment are known to have occurred from this AOC. Releases to the environment through dust and spillage may have occurred during the loading and unloading of the silos.

1.9.4 Data Gaps

- Condition of the soil beneath the silos (should not be a concern, as the soil is capped by asphalt and concrete).

Assess the condition of asphalt and concrete after the silos are disassembled and removed from the site. If asphalt and/or concrete appear to be compromised a soil sample will be collected during the installation of MW -119.

- Site-wide groundwater monitoring will be assessed for anomalies in pH.

The current site wide groundwater sampling plan (see section 1.2) includes pH monitoring during sampling events. The pH recorded during a year of quarterly monitoring events will be assessed for anomalies.

A closure report will be completed.

1.10 AOC-D1 Pilot Plant (including QA/QC Labs and small packaging area) and AOC-D2, Main Mixing Area

1.10.1 Description of Unit Function, Components and Materials Managed

These AOCs consist of the Pilot Plant, the QA/QC labs, the small packaging area, a satellite hazardous waste container storage area and the Main Mixing area. They are located in the northeastern end of the Huntingdon Avenue building. These AOCs have been combined due to their proximity in the same building and the similar nature of their past operation and constituents of concern.

No documented releases to the surrounding environment are known to exist for these AOCs.

Within the Pilot Plant, small batches of sample products were produced for MacDermid's customers. The aboveground process tanks located within the Pilot plant range from 5 gallons to 750 gallons in size. The types of chemicals which have been managed within this AOC include: copper etchant, solder stripper, inks, electroless nickel plating solution, dry batch chemicals and components of these materials (TRC, 1993).

To prevent releases to the environment, the Pilot Room was constructed with a concrete floor which is sloped towards a collection sump. Historically, material within the collection sump were either containerized or discharged to MacDermid's industrial wastewater treatment system (WWTS).

The main mixing area was formerly used to blend copper plating solution. This AOC was used to repackage dry chemicals into small units for off-site sale.

To prevent releases to the environment, this AOC was equipped with a dust collector, epoxy-coated concrete floor and floor trenches. The floor trenches are connected to MacDermid's WWTS (i.e., AOC-E2). The floor in this area appears eroded from past use.

1.10.2 Potential Release Pathways

- **Surface Water and Sediments**

Any spillage from these operations was contained in the building and discharged to the site WWTP.

- **Soils**

Soils would only be impacted if there were any significant leakage through the concrete floor.

- **Groundwater**

Spillage from these AOCs would have been contained in the building and/or flowed to the site WWTP. Groundwater would only be impacted if there were any significant leakage through the concrete floor.

- **Air**

Chemical processes are removed and this pathway no longer exists.

1.10.3 History of Releases, Investigations and Remediation

Spills or releases within the QA/QC lab and the small packaging area would be contained by the area's concrete floor and building walls.

Monitoring wells MW-104 and MW-105 appear to be located downgradient of AOC-D1 and D2. No metal, cyanide, or VOC CT-RSR exceedances were detected in the 1995 soil sample or in the February 2001 groundwater monitoring results.

Boring log for monitoring well MW-105 indicated no visual signs of potentially contaminated soil. The low field PID results listed in MW-105's boring log indicates no significant source of VOC contaminated overburden soils. No boring log was available for review for monitoring well MW-104.

Investigations performed in the area of AOC-D2 are summarized in the following reports.

IPC Corporation Groundwater Investigation (estimated 1988); Monitoring well MW-104 was installed by the IPC Corporation. No boring log or well completion report and no IPC groundwater monitoring data could be located for the monitoring well.

GZA's Soil and Groundwater Investigations (1995); On February 15, 1995 GZA installed monitoring well MW-105. During installation, a soil sample was collected 15-17 feet bg.

The sample was submitted for analysis of TCLP extractable metals and VOCs by Method 8260. No CT RSR PMC standard was exceeded from the soil sample. In 1995, groundwater samples were collected by GZA from MW-104 and MW-105 and analyzed for dissolved metals, total and amenable cyanide, fluoride, and VOCs by EPA method 8260.

HRP's Groundwater sampling event (2001); In February 2001, HRP collected groundwater samples from MW 105; the samples were analyzed for dissolved metals, total and amenable cyanide, fluoride, and VOCs by EPA method 8260. No CT-RSR SWPC or I/C VC standards were exceeded in the sample.

Monitoring wells MW-104 and MW-105 appear to be located downgradient of AOC-D2.

1.10.4 Data Gaps

- Presence of any cracks in the concrete with penetrations to the subsoil which would allow contamination by constituents of concern.

Visually assess the condition of concrete floor within the building in the Pilot Plant, the QA/QC labs, the small packaging area, and satellite hazardous waste container storage area.

- Establish if there has been any release through the concrete floor within this building if the concrete has been compromised.

The concrete floor in the main mixing area has been determined to be in poor condition and it is necessary to take samples from beneath the concrete. To assess if there has been a release in the main mixing area, borings (SB-19, SB-20 and SB-21) will be drilled to below the depth of any apparent contamination or waste material. Following the collection of subsurface soil samples, each subsurface soil boring will be abandoned by grouting the boring from the bottom of the boring to the top.

Soil samples with the greatest degree of contamination, based on field screening and observations will be selected for chemical analysis. If obvious contamination is encountered during the drilling event, it may be necessary to install additional borings and/or groundwater monitoring wells to assess the extent of the release.

Each sample will be analyzed for VOCs, RSR-15 Metals, Cyanide, Tin and ETPH. SPLP analysis will be done for metals on a contingent basis if required to determine compliance with the GB PMC for other parameters. Based on visual assessment of the concrete floor within the building in the Pilot Plant, the QA/QC labs, and the small packaging area, additional borings may be necessary (SB-50, SB-51 and SB-52).

One groundwater monitoring well (MW-120) will be installed in the main mixing area. The monitoring well will be installed using either a Geoprobe-drill rig or a conventional hollow stem auger rig.

The monitoring well will be installed to intersect the apparent groundwater table (approximately 35 feet). The well will be constructed of 2-inch diameter Schedule 40 PVC 0.010-inch machine slotted screen and riser pipe. The annular space between the well screen and borehole wall will be backfilled with chemically inert sand and a bentonite clay seal above the sand pack. The remaining annular space will be filled to grade with cement/bentonite grout. The monitoring well will be fitted with a flush-mounted curb box secured with cement.

The newly installed well will be developed by bailing a minimum of three well casing volumes from the well until the water is reasonably visibly clear or the turbidity of the water has been noticeably reduced.

Groundwater samples will be collected as described in the current site wide groundwater sampling plan (see section 1.2) Groundwater samples will be collected and analyzed for VOCs, SVOCs, TAL metals, Cyanide and Tin.

- Extent of contamination to concrete by constituents of concern.

Chip sampling will be performed following procedures as described in the QAPP. A carbide bit drill will be used on a rotary impact hammer drill to create dust to collect for samples. The chip samples will be analyzed for Constituents of Concern, including VOCs, RSR-15 metals, Cyanide, Tin, and ETPH.

1.11 AOC-E1 Former Waste Lagoons

1.11.1 Description of Unit Function, Components and Materials Managed

AOC-E1 is comprised of two (2) lagoons, which were used from circa 1930 to 1978, as the discharge areas for organic and inorganic process waste. The two lagoons were located on the western side of the Huntingdon Avenue building.

Until 1972, MacDermid discharged its wastewater to on-site catch basins. In 1972, MacDermid installed a Waste Water Treatment System (WWTS) that used two lagoons, one inorganic and one organic. The lagoons settled waste sludge, while the liquid supernatant was discharged to catch basins (CTDEP, 1984a; CTDEP, 1987a). In 1978, an additional WWTS was installed that neutralized the wastewater discharge. The two lagoons were excavated and the sludge removed. Documentation of the sludge disposition was unavailable.

From 1978 to 1980, the metal hydroxide sludge from the new WWTS was stockpiled in a new lagoon near the site of the old lagoons.

In 1982 or 1983, this sludge pile was excavated and approximately 168 cubic feet were sent to the Archer Landfill in Shelton, Connecticut (CTDEP, 1987a).

A review of a 1975 aerial photograph obtained from the Connecticut Department of Natural Resources indicates that one of the former lagoons was located beneath what is currently the Bulk Waste Loading and Storage Area and the Acid Tank Farm. The approximate dimensions of this lagoon were 190 feet by 60 feet. A review of a 1980 aerial photograph indicates that the second lagoon was located west of the 1975 lagoon area. The approximate dimensions of the 1980 lagoon were 120 feet by 40 feet. The lagoons are not visible in 1986, 1990, or 1994 aerial photographs.

In 1982 or 1983, the sludges from both lagoons were reportedly excavated and disposed of off site. The soils underlying the lagoons were excavated and placed in AOC-A. Within these lagoons, the solids settled to the bottom and the liquid was decanted and discharged to the municipal sewer systems.

1.11.2 Potential Release Pathways

- **Surface Water and Sediments**

The former lagoons are covered and are not in direct contact with rainwater.

- **Soils**

Documentation of the lagoon excavations are not available. There is potential for there to be residual soil impacts if waste remains in the lagoons.

- **Groundwater**

Any waste or contaminated soil remaining in the lagoons could impact groundwater.

- **Air**

This pathway is non existent unless the lagoons are excavated.

1.11.3 History of Releases, Investigations and Remediation

In January/February 1995, GZA installed a total of five (5) borings within the estimated footprints of the two (2) former waste lagoons. The locations of these borings were designated B-2, B-3, B-4, MW-108, and MW-109. MW-108 and MW-109 are overburden groundwater monitoring wells. Based on the results of GZA's 1995 soil/groundwater investigation and HRP's February 2001 groundwater sampling event, it appears that a release may have residual soil impact exists from AOC-E1.

Soil samples from B-2 and MW-108 exhibited metal concentrations (chromium, lead and/or nickel) above CT-RSR's PMC standards.

Well MW-108 continues to exhibit a light non aqueous phase liquid (LNAPL). A floating petroleum product (approximately 6 inches in depth) was observed in monitoring well MW-108 on February 8, 2001. Prior to sampling this well on February 8, 2001, the floating petroleum product was removed using bailers. This well, which was re-surveyed on February 12 and 14, 2001, was noted to contain approximately 3 inches and 2 inches of floating petroleum product, respectively. A sample of the petroleum product was submitted to EAS for fingerprinting on February 12, 2001. The petroleum product was determined to contain primarily High Range Organics (HRO). HRO is comprised of organic compounds which contain approximately 20 to 40 carbon atoms. According to EAS, the petroleum product is substantially similar to 30 weight motor oil. Surrounding monitoring wells MW-109 and MW-110 and assumed downgradient monitoring well MW-111 contain no visible petroleum product or petroleum sheen. Monitoring well MW-110; however, did exhibit a green tint.

Groundwater also exhibited concentrations of metals (e.g., copper, nickel, and zinc) and cyanide above the CT-RSR's SWPC standards. Boring logs for borings B-3 and B-4 indicated no visual or olfactory signs of contaminated soil. Boring logs for monitoring well MW-8 indicted the presence of some black staining at the depth of 10 to 12 feet. The spoils from monitoring wells MW-108 and MW-109 were reported to have a "sweet" odor. The field PID readings for boring B-2, and monitoring wells MW-8 and MW-9 were ≤ 0.9 ppm indicates no significant source of VOC contaminated overburden soils at these boring/monitoring well locations.

1.11.4 Data Gaps

- Assess the degree and extent of the LNAPL at MW-108.
- Assess options for the interim remediation of the LNAPL.
- Assess if any residual waste or contaminated soils remain in the buried lagoons.
- Assess the horizontal and vertical extent of the former lagoons.
- Characterize any contaminated soil or waste remaining in the former lagoons.

To assess if any residual waste or contaminated soils remain, samples from borings SB-28, SB-29, SB-31/MW-131, SB-32 and SB-34 will be collected to characterize material within what is estimated to be the center of the buried lagoons. In addition, if waste material is encountered in borings drilled at what is thought to be the limits of the former waste lagoons (SB-25, SB-26, SB-27, SB-30, SB-33, SB-35 or SB-36) samples will be taken and analyzed to better assess the extent and characterize the material.

Borings will be drilled using a direct push drill rig to below the depth of any apparent contamination or waste material. Following the collection of subsurface soil samples, each subsurface soil boring will be abandoned by grouting the boring from the bottom of the boring to the ground surface. To assess the degree and extent of the LNAPL in MW-108, soil samples will be taken during the installation of MW-122, MW-123, MW-124 and MW-125. Soil samples will be selected for chemical analysis from each boring based on greatest degree of contamination. The greatest degree of contamination will be identified by field screening of the borings with a PID and/or by visual observations. Borings will be advanced to below any apparent fill material to verify the extent of the lagoon area excavations.

Each sample will be analyzed for VOCs, RSR-15 metals, Cyanide, Tin, pH and ETPH. Soil samples taken from MW-122, MW-123, MW-124 and MW-125 will also be analyzed for ETPH. Three samples SB-27, SB-28 and SB-30 will also be analyzed for waste disposal criteria. SPLP analysis will be done for metals on a contingent basis if required to determine compliance with the GB PMC for other parameters.

Borings SB-25, SB-26, SB-27, SB-28, SB-33, SB-35 or SB-36 will be collected at what is thought to be the limits of the former lagoons to estimate horizontal extent, and SB-28, SB-29, SB-31/MW-131, SB-32 and SB-33 will be collected from center of the disposal area to estimate depth. Additional borings will be drilled to confirm the former lagoons limits if borings SB-25, SB-26, SB-27, SB-30, SB-33, SB-35 or SB-36 appear to be in the lagoons area based on field observations.

Five wells will be installed (MW-122, MW-123, MW-124, MW-125, and SB-31/MW-131) down-gradient and cross-gradient from the area of the former lagoons. The wells will be installed and groundwater samples will be collected as described in the current site wide groundwater sampling plan (see section 1.2). Groundwater samples will be collected and analyzed for VOCs, TAL metals, ETPH, Cyanide, and Tin.

1.12 AOC-E2 Wastewater Treatment System

1.12.1 Description of Unit Function, Components and Materials Managed

The Wastewater Treatment System (WWTS) was located on the southwestern side of the Huntingdon Avenue building and operated from 1978 to 2002. The WWTS consisted of eight (8) 15,000-gallon lined concrete batch treatment tanks, four (4) 15,000-gallon collection tanks, two (2) 3,000-gallon metal hydroxide (MOH) slurry tanks, a 4,000-gallon recirculation tank, an ultrafiltration unit, a 15-cubic foot filter press, and a 26-cubic yard MOH sludge roll-off container. The 15,000 gallon tanks, designed to allow for segregated chemical treatment, were utilized for batch treatment of wastewaters from the entire facility.

The WWTS was used to treat wash waters and spills generated primarily from copper etchant process area, main mixing area, the pilot plant department, dry mix department, bulk waste loading and storage area and ink manufacturing area.

The original WWTS—which did not contain the MOH slurry tanks, filter press, the MOH roll-off and ultrafiltration system—was installed in 1978. The MOH filter press and roll-off were added in 1980; the ultrafiltration system was installed in 1992. The wash waters/spills were treated for the removal of the following pollutants: ammonia, chromium (hexavalent), chromium (total), copper, cyanide (amenable), cyanide (total), fluoride, iron, nickel, tin, zinc, and pH.

After treatment in the batch tanks, wastewater was pumped via a combination of four diaphragm pumps to the microfiltration recirculation tank prior to microfiltration. The sludge from the bottom of each batch tank was pumped via a combination of the same diaphragm pumps to the two sludge holding tanks located in the sludge room. An Integrated Membrane Filtration System was utilized for final polishing of the effluent from the batch treatment tanks prior to discharge to the wastewater holding tanks. The system was designed to filter heavy metals remaining in the wastewater after precipitation and solids settling in each of the batch treatment tanks. After batch treatment and microfiltration polishing, the treated effluent was pumped to one of three 15,000-gallon aboveground fiberglass holding tanks. These holding tanks were used to store treated effluent for testing prior to discharge to the sanitary sewer. Treated effluent was discharged to the city of Waterbury's sewage treatment facility pursuant to National Pollutant Discharge Elimination System (NPDES) Permit # SP0000095. MacDermid was authorized to discharge 60,000 gallons per day under this permit.

Metal hydroxide/sulfide sludge was discharged from the on-site wastewater treatment system to two 3,200 gallon holding tanks. The semi-liquid sludge was then transferred to a filter press, which discharged dewatered sludge directly into 30-cubic yard lined roll off. Once full, the roll-off was shipped off-site to a permitted facility for final treatment and disposal.

The sludge was stored in a 30 cubic yard polyethylene lined roll-off which was housed in a 650-square foot storage building located at the southern side of the Huntingdon Avenue Building and east of the bulk loading/unloading area. Secondary containment in this area is provided by the interior and exterior concrete walls, a 4-inch berm and a floor trench that discharged directly to the on-site wastewater treatment system. An epoxy coating was applied to this area; however, the application date is unknown. The majority of the epoxy coating has worn away. The area of the MOH sludge storage in the two 3,000-gallon tanks and the former dried sludge roll off container are considered RCRA storage areas subject to closure requirements.

The WWTS tanks were constructed of steel, concrete, or fiber-reinforced plastic (FRP). The tanks were located on a concrete floor and are surrounded by a concrete berm.

The batch treatment tanks were also connected to a wet scrubber system, which removed ammonia vapors. No documented releases to the surrounding environment are known to exist for this AOC.

Spent etchant recycling activities at the Huntingdon Avenue facility were last performed in December 2001. Chemical production and laboratory activities performed at the Huntingdon Avenue facility ceased in April 2002. Wastewater treatment activities were discontinued in May 2002.

1.12.2 Potential Release Pathways

- **Surface Water and Sediments**

All WWTS operations are stopped and chemicals removed. During operation any releases would have been directed to the WWTS and discharged via the NPDES permit.

- **Soils**

Most of these operations were indoors with secondary containment with little potential for direct soil contact. Seepage through the concrete floors is possible if the floor were compromised.

- **Groundwater**

Groundwater would be impacted from this AOC only if there had been a release to soil.

- **Air**

This pathway is negligible with the operation closed.

1.12.3 History of Releases, Investigations and Remediation

As discussed in AOC-E1, groundwater in this area has been impacted. Groundwater exhibited metal concentrations (e.g., copper nickel, and zinc) and cyanide above the CT-RSR's SWPC standards.

In January 2003, LEA submitted a Closure Plan for the Waste Water Treatment System to the CT-DEP. This plan was accepted by the CT-DEP in a letter dated February 11, 2003. Upon report of completion of closure activities, Permit #SP0000095 was terminated.

During September 2007, the building housing the sludge storage and roll-off container, (Area E in the Closure Plan) was demolished by EQ. MacDermid and EQ are in the process of characterizing approximately 60 tons of impacted soil removed from below this building.

1.12.4 Data Gaps

- Assess the status of closure of the RCRA regulated portion of this AOC and implement RCRA closure activities as needed.

In January 2003, LEA submitted a Closure Plan for the WWTS to the CT-DEP. This plan was accepted by the CT-DEP in a letter dated February 11, 2003. The WWTS area will be closed following the guidance of the approved Wastewater Treatment closure plan. A copy of the WWTS Closure plan and the CT DEP acceptance letter is included in Appendix D.

- Assess the potential for this area to be a source of the surrounding groundwater impacts described in the history of release section (1.12.3).
- Assess residual impacts to the concrete floor.

To determine if there has been a release in the area of the Waste Water Treatment system, one boring (SB-24) will be drilled. The boring will be drilled using a Geoprobe direct push drill rig to below the depth of any apparent contamination or waste material.

A soil sample will be selected for chemical analysis from the boring based on greatest degree of contamination. The greatest degree of contamination will be identified by field screening of the borings with a PID and/or by visual observations.

Following the collection of the subsurface soil sample, the soil boring will be abandoned by grouting the boring from the bottom of the boring to the ground surface.

The sample will be analyzed for VOCs, RSR-15 metals, Cyanide, Tin, and ETPH. SPLP analysis will be done for metals on a contingent basis if required to determine compliance with the GB PMC for other parameters.

One groundwater monitoring well (MW-121) will be installed in the area of the Waste Water Treatment System. The monitoring well will be installed using either a Geoprobe drill rig or a conventional hollow stem auger rig. The monitoring well will be installed to intersect the apparent groundwater table (approximately 35 feet). The well will be constructed of 2-inch diameter Schedule 40 poly vinyl chloride 0.010-inch machine slotted screen and riser pipe. The annular space between the well screen and borehole wall will be backfilled with chemically inert sand and a bentonite clay seal above the sand pack. The remaining annular space will be filled to grade with cement/bentonite grout. The monitoring well will be fitted with a flush-mounted curb box secured with cement.

The newly installed well will be developed by bailing a minimum of three well casing volumes from the well until the water is reasonably visibly clear or the turbidity of the water has been noticeably reduced.

Groundwater samples will be collected as described in the current site wide groundwater sampling plan (see section 1.2.). Groundwater samples will be collected and analyzed for VOCs, SVOCs, TAL metals, Cyanide, and Tin.

1.13 AOC-E3 Bulk Spent Copper Etchant Unloading Storage Area

1.13.1 Description of Unit Function, Components and Materials Managed

The Bulk Spent Copper Etchant Unloading and Storage Area was located at the northwestern end of the Huntingdon Avenue building, was used to manage spent copper etchant. This AOC was considered to be a RCRA storage area while in operation.

The enclosed 45 foot by 65 foot Bulk Spent Copper Etchant unloading Area is equipped with a concrete floor, which is sloped towards floor trenches. The floor trenches are connected to the WWTS (i.e. AOC-E2). The Bulk Storage Area for spent copper etchant is located immediately east of the Bulk Spent Copper Etchant Loading Area. Located within the Bulk Storage Area were three (3) 7,500-gallon aboveground FRP storage tanks and one (1) 3,500-gallon aboveground FRP storage tank. The 7,500-gallon storage tanks were used to store spent copper etchant received from MacDermid's customers. The 3,500 gallon tank was used to store the process chemical sodium hydroxide; it would be used to store spent copper etchant only if additional bulk storage capacity was needed (i.e., 22,500-gallon capacity is exceeded).

The Bulk Storage Area, which measures approximately 55 feet by 17.5 feet was equipped with an epoxy coated concrete floor, 2 feet 7 inches high epoxy coated block-wall (south side), epoxy coated building walls (north, east, and west sides), and two (2) collection sumps. Any material collected within the collection sump (located in the northeastern corner of the storage area) was pumped to the main collection sump (located in the middle of the storage area). From the main collection sump, the collected material was pumped to the WWTS (i.e., AOC-E2). The primary hazardous constituents associated with the spent copper etchant are: ammonia, arsenic, chloride, copper, chromium, lead, nickel, tin, and zinc. The start-up date for this AOC is estimated to be 1970.

One exterior wall, two interior walls and a 31 -inch high block wall provide secondary containment for this approximately 1,050 square foot area. The concrete floor and block wall is epoxy coated to a height of 31 inches. The original application date of the epoxy is unknown; however, Stonclad HT was applied to the area in 1998.

The epoxy coating is currently in good condition. One polypropylene-lined concrete floor sump is located in the northwestern corner of this area. This sump feeds to the main collection sump by a level controlled pump and PVC piping.

The main collection sump is located centrally in the unit and pumps to the drum washing sump (outside of the regulated unit) which discharges directly into the wastewater treatment system.

1.13.2 Potential Release Pathways

- **Surface Water and Sediments**

All etchant operations are stopped and chemicals removed. During operation, releases would have been directed to the WWTS and discharged via the NPDES permit. Any releases outside the loading area would have discharged to the site storm drainage.

- **Soils**

These operations were indoors with secondary containment with little potential for direct soil contact. Seepage through the concrete floors is possible if the floor were compromised.

- **Groundwater**

Groundwater would be impacted from this AOC only if there had been a release to soil.

- **Air**

This pathway is negligible with the operation closed.

1.13.3 History of Releases, Investigations and Remediation

A CTDEP inspector noticed on February 10, 1990, that water from a drum washing operation outside the loading area was being allowed to flow into the on-site catch basins. The discharge point for the catch basins is Steele Brook (TRC, 1993). The sediment located directly beneath the catch basins outfall (Steele Brook) was excavated in November 1994 in response to a spent copper etchant spill (see AOC-E6 description). As discussed in AOC-E1, groundwater in this area is impacted. Groundwater exhibited metal concentrations (e.g., copper nickel, and zinc) and cyanide above the CT-RSR's SWPC standards.

On September 18 and 21, 2001, an inspection was conducted by the DEP Bureau of Waste Management in which violations of the RCRA Part B permit. Specifically related to this AOC was the finding that MacDermid failed to maintain adequate secondary containment for the three spent copper etchant tanks.

Specifically, a hole was present in the wall between the spent copper etchant tanks and a nearby brine tank. The floor of the brine tank area was not provided with an impermeable interior coating. Plus, an open seam was noted along the floor at the back of the containment system for the three spent copper etchant tanks.

The building housing the filter bulk spent copper etchant unloading and storage area was constructed directly atop the site of the former 1978 sludge settling lagoon.

In conjunction with the September 2007 demolition of the building housing the sludge storage and roll-off container noted earlier, the floor and several cubic yards of underlying material inside the bulk storage area (Area C in the Closure Plan) were removed by (EQ), with Professional Engineering oversight provided by Mark Franzen, P.E. Impacted soils have been removed to depth. A closure summary report is pending.

1.13.4 Data Gaps

- Assess the status of closure of the RCRA regulated portion of this AOC and implement RCRA closure activities as needed.
- Assess the potential for this area to be a source of the surrounding groundwater impacts.

In conjunction with the September 2007 demolition of the building housing the sludge storage and roll-off container, the floor and several cubic yards of underlying material inside the bulk storage area (Area C in the Closure Plan) were removed by (EQ), with Professional Engineering oversight provided by Mark Franzen, P.E. Impacted soils have been removed to depth. A closure summary report is pending. No additional actions are proposed. Any residual soil and/or groundwater issues in this area will be addressed under the site wide corrective action of the Stewardship permit.

1.14 AOC-E4 Spent Copper Etchant Recycling Area

1.14.1 Description of Unit Function, Components and Materials Managed

This AOC, was constructed circa 1970, is located in the western portion of the Huntingdon Avenue building, houses the spent copper etchant processing area. A portion of this area was considered a RCRA storage unit during operation. This recycling operation formerly contained two (2) aboveground stainless steel reactors, six (6) aboveground ammonia scrub tanks, three (3) aboveground product storage tanks, and various aboveground process chemical tanks. All the tanks from the RCRA regulated area have been removed. A few of the unused process tanks remain in the non-RCRA areas. All tanks within this area were located on an epoxy-coated concrete floor, which is sloped to a floor trench system. The floor trench system is connected to the WWTS (Le. AOC-E2).

The primary hazardous constituents managed within this processing area are: ammonia, arsenic, chloride, copper, chromium, lead, nickel, tin, and zinc.

1.14.2 Potential Release Pathways

- **Surface Water and Sediments**

All etchant operations are stopped and chemicals removed. During operation, releases would have been directed to the WWTS and discharged via the NPDES permit. Any releases outside the loading area would have discharged to the site storm drainage.

- **Soils**

These operations were indoors with secondary containment with little potential for direct soil contact. Seepage through the concrete floors is possible if the floor were compromised.

- **Groundwater**

Groundwater would be impacted from this AOC only if there had been a release to soil.

- **Air**

This pathway is negligible with the operation closed.

1.14.3 History of Releases, Investigations and Remediation

No documented releases to the surrounding environment are known to exist for this AOC. Spills or releases within AOC-E4 would be directed to the WWTS (i.e., AOC-E2) by means of sloped concrete floors and a floor trench system. The IPC Corporation (IPC) installed monitoring wells MW-106 and MW-107 within the area of the copper etchant processing area (date is not known). Based on GZA's 1995 groundwater sampling results, the groundwater in this area has been impacted by metals and cyanide.

1.14.4 Data Gaps

- Assess the tank contents and characterize any residuals that may remain.
- Assess the status of closure of the RCRA regulated portion of this AOC and implement RCRA closure activities as needed.
- Assess the potential for this area to be a source of the surrounding groundwater impacts.

- Assess residual impacts to the concrete floor in the RCRA area and assess for cracks or impacted concrete in the non RCRA areas.

The Bulk Spent Copper Etchant Recycling area will be closed following the procedures and performance standards of the approved Closure Plan for Hazardous Waste Storage area dated January 2003 prepared by LEA. All tanks have been removed from the area.

To determine if there has been a release in the spent copper etchant recycling area the concrete will be assessed visually. Based on visual assessment of the floor within the spent copper etchant recycling area, borings may be necessary (SB-22 and SB-23) to assess if a release has occurred.

Soil samples will be selected for chemical analysis from each boring based on the greatest degree of contamination. The greatest degree of contamination will be identified by field screening of the borings with a PID and by visual observations.

Each sample will be analyzed for VOCs, RSR-15 metals, Cyanide, Tin, and ETPH. SPLP analysis will be done for metals on a contingent basis if required to determine compliance with the GB PMC for other parameters.

Following the collection of subsurface soil samples, each subsurface soil boring will be abandoned by grouting the boring from the bottom of the boring to the top. Upon completion of the RCRA closure a certification report by a P.E. will be prepared. Any residual soil and/or groundwater impacts will be addressed under the site-wide corrective action of the Stewardship Permit.

1.15 AOC-E5 Acid Tank Farm

1.15.1 Description of Unit Function, Components and Materials Managed

This area was used to store bulk quantities of the raw process chemicals: hydrochloric acid, nitric acid, hydrogen peroxide, and sulfuric acid. A maximum of 30,000 gallons of process chemicals were managed within this area at any time. The storage tanks are located outside the building on an epoxy-coated concrete base and surrounded by a 2-foot-high epoxy-coated concrete berm. Within this storage area are two collection sumps, which are connected to the WWTS (i.e., AOC-E2). The start-up date of this AOC is not known.

1.15.2 Potential Release Pathways

- **Surface Water and Sediments**

Operations are stopped and chemicals removed. During operation releases would have been directed to the WWTS and discharged via the NPDES permit. Any releases outside the loading area would have discharged to the site storm drainage.

- **Soils**

These operations had secondary containment with little potential for direct soil contact. Seepage through the concrete floors is possible if the floor were compromised.

- **Groundwater**

Groundwater would be impacted from this AOC only if there had been a release to soil.

- **Air**

This pathway is negligible with the operation closed.

1.15.3 History of Releases, Investigations and Remediation

No documented releases to the surrounding environment are known to exist for this AOC. Spills or releases within AOC-E5 would be directed to the WWTS (i.e., AOC-E5) by means of the asphalt base, concrete-berm, and two (2) collection sumps. To minimize the possibility of any releases from AOC-E5 and other AOCs in the area to the stormwater collection system, MacDermid retrofitted catch basins CB-1, CB-2, and CB-3 with watertight manhole covers in 1998. As discussed in AOC-E1, groundwater in this area has been impacted. Groundwater exhibited metal concentrations (e.g., copper nickel, and zinc) and cyanide above the CT-RSR's SWPC standards.

1.15.4 Data Gaps

- Assess the potential for this area to be a source of the surrounding groundwater impacts.

Groundwater samples will be collected as described in the current site wide groundwater sampling plan (see section 1.2.). Groundwater samples will be collected and analyzed for VOCs, SVOCs, TAL metals, Cyanide, and Tin.

- Assess the integrity of the concrete floor.

Visually assess the condition of concrete floor where the acid tank farm was located. If cracks are noted sampling through the floor will be conducted. Even if no significant cracking is noted, at least two (2) samples will be collected through the etched concrete under the former tanks.

1.16 AOC-E6 and 1994 Spent Copper Etchant Spill

1.16.1 Description of Unit Function, Components and Materials Managed

In November 1994, approximately 1,500-gallons of spent copper etchant were accidentally released to the Steele Brook through the stormwater collection system.

It is believed that this release was caused by the vacuum generated from the piping system of a non-contact cooling water discharge.

A mixture of non-contact cooling water and spent copper etchant was discharged to catch basin CB-2 or CB-3.

The discharge of non-contact cooling water was authorized by a CT-DEP permit. The discharge of non-contact cooling water was eliminated by MacDermid in the spring of 1997. Upon discovery of this release, MacDermid removed the copper etchant from the 4,000-gallon storage tank and immediately contacted the CT-DEP.

1.16.2 Potential Release Pathways

- **Surface Water and Sediments**

During operation the releases discharged to the site storm drainage and Steele Brook.

- **Soils**

The spill was contained to the storm sewer system and the receiving stream.

- **Groundwater**

The spill was contained to the storm sewer system and the receiving stream.

- **Air**

This pathway is negligible.

1.16.3 History of Releases, Investigations and Remediation

The CT-DEP supervised the initial removal activities which included removing more than 30,000 gallons of water and copper etchant from Steele Brook. Following the removal activity, MacDermid hired HRP to sample the sediment within Steele Brook. The results of HRP's sampling activity were submitted to the CT-DEP on December 24, 1994 in a report titled STEELE BROOK/NAUGATUCK RIVER SEDIMENT SAMPLING RESULTS.

A total of fifteen (15) sediment samples were collected and analyzed for copper, lead, nickel, and zinc by mass analysis. The metal concentrations, in general, decreased as the downgradient sampling distance from the outfall of the stormwater drainage system increased.

The two (2) sediment samples collected upgradient of stormwater drainage system's outfall (2 and 6) also exhibited relatively concentrations of the metals copper, lead, nickel, and zinc. The Steele Brook and the stormwater drainage system, which received MacDermid's 1994 spent copper etchant spill, have been used for years as the discharge location by other manufacturing facilities for industrial wastewaters. Although the CT-RSR currently contains no standards for sediment, all the 1994 sediment samples exhibited concentrations below the CT-RSR's Residential DEC standards.

1.16.4 Data Gaps

- Previous RSR closure reporting will be compared to current ecological risk screening guidance.

The CT-DEP supervised the initial removal activities which included removing more than 30,000 gallons of water and copper etchant from Steele Brook. Following the removal activity, MacDermid hired HRP to sample the sediment within Steele Brook. The results of HRP's sampling activity were submitted to the CT-DEP on December 24, 1994 in a report titled STEELE BROOK/NAUGATUCK RIVER SEDIMENT SAMPLING RESULTS.

A total of fifteen (15) sediment samples were collected and analyzed for copper, lead, nickel, and zinc by mass analysis. The metal concentrations, in general, decreased as the downgradient sampling distance from the outfall of the stormwater drainage system increased. The two (2) sediment samples collected upgradient of stormwater drainage system's outfall (2 and 6) also exhibited relatively elevated concentrations of the metals copper, lead, nickel, and zinc. The Steele Brook and the stormwater drainage system, which received MacDermid's 1994 spent copper etchant spill, have been used for years as the discharge location by other manufacturing facilities for industrial wastewaters. Although the CT-RSR currently contains no standards for sediment, all the 1994 sediment samples exhibited concentrations below the CT-RSR's Residential DEC standards. The previous spill clean-up and closure data will be reviewed and compared to current ecological risk screening guidance. Conclusions will be made if additional sampling or remediation is warranted to be protective of ecological receptors.

1.17 AOC-F Former 6,000 Gallon UST (East Aurora Street Building)

1.17.1 Description of Unit Function, Components and Materials Managed

This AOC was comprised of one (1) 6,000 gallon UST located on the eastern side of the East Aurora Street building. This former #2 fuel oil storage tank was installed in 1978 and removed from service in September 1998. Due to the location of this AOC (partially beneath the East Aurora Street building), it was abandoned in-place.

The remaining fuel oil was removed from the tank and the tank was cleaned and filled with petrofill foam. Documentation for this tank closure activity is not available.

1.17.2 Potential Release Pathways

- **Surface Water and Sediments**

There is negligible risk to this pathway since the tank has been closed.

- **Soils**

Soil could have been impacted only if there was a leak from the tank.

- **Groundwater**

Groundwater could have been impacted only if there was a leak from the tank.

- **Air**

This pathway is negligible.

1.17.3 History of Releases, Investigations and Remediation

No documented releases to the surrounding environment are known to exist for this AOC. Releases from the UST in this AOC may have occurred if the structural integrity of the UST had been impacted prior to abandonment in-place or during filling operations. Monitoring well MW-105 appears to be located immediately downgradient of AOC-F. No petroleum hydrocarbon sheen or organic compounds typically contained in petroleum products were observed in MW-105 during the February 2001 sampling event.

Boring logs for monitoring well MW-105 indicated no visual signs of potentially contaminated soil. The field PID readings for MW-105 were ≤ 0.9 ppm (relative to benzene in air), which indicate no significant source of VOC contaminated overburden soils at this location.

1.17.4 Data Gaps

- Groundwater downgradient from this area will be assessed with the site-wide groundwater conditions.

To assess if there has been a release from a former #2 fuel oil storage tank borings (SB-17 and SB-18) will be drilled using a Geoprobe direct push drill rig to below the depth of the base of the tank and below the depth of any apparent contamination or waste material.

Soil samples will be selected for chemical analysis from each boring based on greatest degree of contamination. The greatest degree of contamination will be identified by field screening of the borings with a photoionization detector (PID) and by visual observations.

Each sample will be analyzed for VOC, SVOCs and ETPH.

Following the collection of subsurface soil samples, each subsurface soil boring will be abandoned by grouting the boring from the bottom of the boring to the top.

Groundwater samples will be collected as described in the current site wide groundwater sampling plan (see section 1.2). Groundwater samples will be collected and analyzed for VOCs, TAL metals, ETPH, cyanide, and Tin.

MacDermid and GEI will continue to search for documentation of past closure activities.

1.18 AOC-G East Aurora Street Warehouse

1.18.1 Description of Unit Function, Components and Materials Managed

The East Aurora Street warehouse, which is located in the center of the site, was constructed in circa 1985. This AOC consists of the main hazardous waste storage area ("Main Container Storage Area"), the quality control area, the finished product storage area and the shipping/receiving area. Two portions of this AOC are former RCRA regulated storage units subject to closure.

The main hazardous waste storage area was used by MacDermid for the storage of copper etchant solution in containers, process chemicals (excluding solvents) in containers, finished products in containers, wooden pallets, empty containers, and miscellaneous items such as scrap steel, office equipment, etc.

The area was proposed in the original 1999 "*Hazardous Waste Part B Permit Application Renewal*" to have a maximum of 46,640 gallons of spent copper etchant (728 55-gallon drums and/or 20 220/330-gallon totes). This rectangular-shaped storage area measures 93' long by 42' wide. Secondary containment was provided by an epoxy-coated concrete floor, building walls, 38" high concrete berms and a collection sump. The material collected within the sump was pumped to MacDermid's WWTS (i.e., AOC-E2).

The quality control area ("Quality Control [QC] [waste staging area]") is located immediately east of the main hazardous waste storage area and was used for performing spot tests on containers of spent copper etchant.

The area was proposed in the original 1999 "*Hazardous Waste Part B Permit Application Renewal*" to have a maximum of 6,380 gallons of spent copper etchant. Secondary containment within this triangular-shaped storage area is provided by an epoxy-coated concrete floor, building walls and 3 1/2" to 6" high concrete berms.

Secondary containment within the finished product storage area and the shipping/ receiving area is provided by an epoxy-coated floor and building walls. No floor drains are known to be located in these areas. The areas immediately outside this AOC are covered with asphalt.

1.18.2 Potential Release Pathways

- **Surface Water and Sediments**

All waste storage and QA/QC operations are stopped and chemicals removed. During operation releases would have been contained in the building. Any releases outside the loading area would have discharged to the site storm drainage.

- **Soils**

These operations were indoors with secondary containment with little potential for direct soil contact. Seepage through the concrete floors is possible if the floor were compromised.

- **Groundwater**

Groundwater would be impacted from this AOC only if there had been a release to soil.

- **Air**

This pathway is negligible with the operation closed.

1.18.3 History of Releases, Investigations and Remediation

In March 1995, February 2001, July 2006, October 2006, February 2007 and May 2007 Groundwater samples were collected from MW-111. Results from the 2001 samples indicated a level of zinc that exceeded CT RSR SWPC standards.

Sampling of the concrete floors has been conducted in both RCRA storage areas. This sampling shows some relatively minor impacts that may warrant decontamination. However, there is no current indication of a significant release to soil or groundwater from this area.

1.18.4 Data Gaps

- The current RCRA closure plans for the two storage areas will be reviewed and plans made for their implementation.
- Extent of contamination of concrete by constituents of concern. Some concrete chip sampling was conducted by LEA, but the sample results have not been thoroughly evaluated.

In January 2003, LEA submitted a Closure Plan for the Hazardous Waste Storage Areas to the CT-DEP. The Main Hazardous Waste Storage Area and the Quality Control Area will be closed following the procedures and performance standards of the Closure Plan for the Hazardous Waste Storage Areas.

- Presence of any cracks in the concrete with penetrations to the subsoil which would allow contamination by constituents of concern.

Visually assess the condition of concrete floor in the East Aurora Street warehouse.

- Continued evaluation of the site-wide groundwater system will better assess if there has been a release to groundwater.

Two additional groundwater monitoring wells will be installed downgradient from this AOC (MW-126 and MW-127). The wells will be installed and soil samples will be taken during installation. Groundwater samples will be collected as described in the current site wide groundwater sampling plan (see section 1.2). Groundwater samples will be collected and analyzed for VOCs, SVOCs, TAL metals, TPH, cyanide, and Tin. Any residual groundwater impacts will be addressed as part of the site wide corrective action under the Stewardship permit.

1.19 AOC-H Flammable Material Rack Storage Area

1.19.1 Description of Unit Function, Components and Materials Managed

The Flammable Material Rack Storage Area was located on the northwestern side of the site, approximately 200 feet north of the Gear Street Building. This outdoor storage area, which was 40 feet long by 25 feet wide, was used to store containers of raw flammable chemicals such as alcohols, solvents, etc. The racks have been removed; only a concrete slab remains.

Within this storage area the raw material containers were stored on a four-tier high drum rack system. Secondary containment was provided by a concrete floor and a three (3) inch high concrete berm. No documented releases to the surrounding environment are known to exist for this AOC. In the event of a spill or release outside this AOC's secondary containment area, the releases would flow towards the on-site catch basins. All raw material transfer operations at MacDermid were performed by experienced forklift operators. Spill control equipment was maintained inside AOC-H.

1.19.2 Potential Release Pathways

- **Surface Water and Sediments**

All flammable storage operations are stopped, chemicals removed and the building demolished. During operation, releases would have been contained in the building. Any releases outside the loading area would have discharged to the site storm drainage. The building was equipped with spill control equipment.

- **Soils**

These operations were indoors with secondary containment with little potential for direct soil contact.

Seepage through the concrete floors is possible if the floor were compromised.

- **Groundwater**

Groundwater would be impacted from this AOC only if there had been a release to soil.

- **Air**

This pathway is negligible with the operation closed.

1.19.3 History of Releases, Investigations and Remediation

On January 13, 1995, GZA installed groundwater monitoring well MW-112 immediately north of the Gear Street Building. During the installation of MW-112, GZA collected and analyzed the soil sample collected from the 0.5-2.5 foot horizon. Only the PMC standard for lead was exceeded.

The boring log for monitoring well MW-112 indicated the presence of cinders/ash (fill) at the depth of 0.5 to 2.5 feet. The field PID readings for the soils screened during the installation of MW-112 were below laboratory detection limit (i.e., indicating that no VOC contaminated overburden soils were detected at this location).

In March 1995, February 2001, July 2006, October 2006, February 2007 and May 2007 groundwater samples were collected from MW-112 and analyzed for dissolved metals, total and amenable cyanide, fluoride and VOCs by EPA Method 8260. Only the SWPC for zinc was slightly exceeded in February 2001. This lead contamination may have been caused by the Waterbury Steel Ball Company who occupied the Gear Street Building from prior to 1922 to circa 1977.

1.19.4 Data Gaps

- It is unknown if there were any releases to soil under or around the former storage area.
- Presence of any cracks in the concrete with penetrations to the subsoil which would allow contamination by constituents of concern.

To determine if there has been a release in Flammable Material Rack Storage Area the concrete will be assessed visually and two borings (SB-37 and SB-38) will be placed just off the concrete pad. The borings will be drilled using a Geoprobe direct push drill rig to below the depth of any apparent contamination or waste material.

Soil samples will be selected for chemical analysis from each boring based on greatest degree of contamination.

The greatest degree of contamination will be identified by field screening of the borings with a PID and by visual observations.

Each sample will be analyzed for VOCs, RSR-15 Metals, ETPH, and Tin. SPLP analysis will be done for metals on a contingent basis if required to determine compliance with the GB PMC for other parameters.

Following the collection of subsurface soil samples, each subsurface soil boring will be abandoned by grouting the boring from the bottom of the boring to the top.

- Continued evaluation of the site-wide groundwater system will better assess if there has been a release to groundwater.

Groundwater samples will be collected as described in the current site wide groundwater sampling plan (see section 1.2).

1.20 AOC-I Ink Spill Area

1.20.1 Description of Unit Function, Components and Materials Managed

In 1987, IPC personnel discovered stained soil underneath a concrete pad located north of the Gear Street Building and near a former ink spill sump. The spill material appeared to be an epoxy-like ink product which was manufactured at MacDermid. The material safety data sheet for the MacDermid ink product MACUMASK 9415 (suspected spill material) was reported to be comprised of; pigments (organic, non-metallic) catalyst (aromatic ketones), vehicle (acrylic monomers) and additives (inert filler such as MgO).

The release was reported to the CTDEP and cleaned-up in accordance with CT-DEP's "Contaminated Soils Removal and Disposal Guidelines".

Approximately 550 cubic feet of soil was reportedly removed from this release area and disposed off site

1.20.2 Potential Release Pathways

- **Surface Water and Sediments**

All ink handling and storage operations are stopped and chemicals removed. During operation releases would have been contained in the building. Any releases outside the building could have discharged to the site storm drainage.

- **Soils**

These operations were indoors with secondary containment with little potential for direct soil contact. Seepage through the concrete floors is possible if the floor were compromised. The historical spill soil impacts will be reviewed relative to current standards.

- **Groundwater**

Groundwater may have impacted from this AOC from the historical spill.

- **Air**

This pathway is negligible with the operation closed.

1.20.3 History of Releases, Investigations and Remediation

This release was reported to have occurred from the former ink spill sump. The date this release occurred is not known. The remedial measures performed at this AOC in 1987/1988 are reported to be as follows:

- Following removal of the concrete pad collected two (2) composite soil samples from the western face of the excavation at the following locations:
 - 30 inches below grade, visually clean soil.
 - 18 inches below grade, ink/soil layer.
- Based on soil sampling results excavated to a depth of 30-36 inches. The area of excavation was 11.5 feet by 16 feet.
- Following excavation collected a composite soil sample from the bottom of the excavation in November/December 1987.
- Collected soil samples from the eastern and western face (i.e., sidewalls) of the excavation in March 1988.
- Based on the November/December 1987 and March 1988 soil sampling results requested CT-DEP approval to backfill the excavation.

The excavation area was backfilled and is now covered with asphalt (i.e., part of the parking lot). No written approval to backfill this excavation is known to have been received from the CT-DEP.

On January 15, 1995, GZA installed groundwater monitoring well MW-113 immediately south of the Gear Street building. This monitoring well, which appears to be located hydraulically downgradient of AOC-I, was sampled by GZA in March 1995 and HRP in February 2001.

Based on the groundwater monitoring results, only the CT-RSR's SWPC for zinc was slightly exceeded in February 2001. No solvents, which were detected in 1987/1988 soil sampling activity, have been detected in the groundwater.

1.20.4 Data Gaps

- The residual from the historical spill and remediation needs to be compared to current soil and groundwater RSRs.

- Continued evaluation of the site-wide groundwater system will better assess if there has been a release to groundwater.

One groundwater monitoring well (SB-48/MW-128) will be installed downgradient of the former Ink Spill area. A soil sample will be collected during the installation of the monitoring well. The monitoring well will be installed and sampled as described in the site wide groundwater monitoring plan (see Section 1.2). Groundwater and soil samples will be collected and analyzed for VOCs, SVOCs, TAL metals, Cyanide and Tin.

1.21 AOC-J 10,000 Gallon UST (Gear Street Building)

1.21.1 Description of Unit Function, Components and Materials Managed

This AOC is comprised of one (1) 10,000 gallon No. 2 fuel oil underground storage tank (UST) located on the northeastern side of the Gear Street building. This UST, which was installed in November 1988, replaced a 4,000-gallon UST that was installed in 1963. The former 4,000-gallon UST was also used to store No. 2 fuel oil.

1.21.2 Potential Release Pathways

- **Surface Water and Sediments**

There is negligible risk to this pathway since these tanks have been closed.

- **Soils**

Soil could have been impacted only if there was a leak from the tanks.

- **Groundwater**

Groundwater could have been impacted only if there was a leak from the tank.

- **Air**

This pathway is negligible.

1.21.3 History of Releases, Investigations and Remediation

On January 15, 1995 GZA installed monitoring well MW-113. This monitoring well, which appears to be located hydraulically downgradient of AOC-J, was sampled by GZA in March 1995 and by HRP in February 2001. Only the CT-RSR SWPC standard for zinc was exceeded in this shallow overburden monitoring well in February 2001.

1.21.4 Data Gaps

- None, the current tank has a monitoring system in place.

One groundwater monitoring well (MW-129) will be installed down gradient from the UST. The monitoring well will be installed and sampled as described in the site wide groundwater monitoring plan (see Section 1.2). Groundwater samples will be collected and analyzed for VOCs, SVOCs, TAL metals, ETPH, cyanide and Tin.

1.22 AOC-K1 Former Flammable Storage Area

1.22.1 Description of Unit Function, Components and Materials Managed

The Former Flammable Storage Area, which was located in the northeastern side of the Gear Street Building was used to store containers of flammable hazardous waste until 1999. Within this former 8 foot by 10 foot storage area, a maximum of sixteen (16) 55-gallon drums of hazardous waste would be managed at any one time. The types of waste managed within this area included flammable waste solvents (e.g., toluene, methyl, ethyl ketone, xylene, etc.). Secondary containment was provided by an epoxy-coated concrete floor and 4" x 4" epoxy-coated angle iron berms.

To determine if the former hazardous waste storage operation had impacted the environment, the following closure activities were initiated in December 1999.

- Analysis of the concrete floor of the former storage area for the hazardous constituents listed under 40 CFR 264 Appendix IX. The results of this analysis were used to finalize the list of constituents of concern (COCs) managed in this former storage area.
- Analysis of concrete floor (discrete samples) of the former storage area for all identified COCs by mass analysis and all metallic COCs by the E.P. Toxicity testing procedure.
- Comparison of the concrete sampling results to the CT-DEP approved closure standards.

Based on the concrete chip sampling results, it was HRP's opinion that this AOC has not impacted the environment (i.e., clean closure). The site was certified by HRP as closed in 2002.

1.22.2 Potential Release Pathways

- **Surface Water and Sediments**

All storage operations are stopped and chemicals removed. During operation releases would have been contained in the building.

- **Soils**

These operations were indoors with secondary containment with little potential for direct soil contact. Seepage through the concrete floors is possible if the floor were compromised.

- **Groundwater**

Groundwater may have impacted from this AOC only if there were a release through the floor.

- **Air**

This pathway is negligible with the operation closed.

1.22.3 History of Releases, Investigations and Remediation

No documented releases to the surrounding environment are known to exist for this AOC. To determine if the former hazardous waste storage operation had impacted the environment, closure activities were initiated in December 1999.

The closure activities, which are summarized in the report entitled, "RCRA Closure Summary for Former Hazardous Waste Storage and Recycling Areas" included the following:

- Analysis of the concrete floor of the former storage area for the hazardous constituents listed under 40 CFR 264 Appendix IX. The results of this analysis were used to finalize the list of constituents of concern (COCs) managed in this former storage area.
- Analysis of concrete floor (discrete samples) of the former storage area for all identified COCs by mass analysis and all metallic COCs by the E.P. Toxicity testing procedure.
- Comparison of the concrete sampling results to the CT-DEP approved closure standards.

Based on the concrete chip sampling results, it was HRP's opinion that this AOC has not impacted the environment (i.e., clean closure). The site was certified by HRP as closed in 2002.

1.22.4 Data Gaps

- None, this area has been closed per an approved RCRA closure plan and certified by a PE.

The closure activities for the Former Flammable Storage Area are summarized in the report entitled, "RCRA Closure Summary for Former Hazardous Waste Storage and Recycling Areas". The Closure Summary and Certification are included in Appendix E.

1.23 AOC K2 Former NMP Recycling Area

1.23.1 Description of Unit Function, Components and Materials Managed

The Former NMP Recycling Area was located in the same room as the Former Flammable Storage Area. This former recycling operation contained a 500-gallon above-ground reactor tank and a 55-gallon stainless steel product tank. Secondary containment was provided by the concrete floor, building walls, and spill collection floor trench. Any material collected within the floor trench would have been discharged to MacDermid's on-site industrial WWTS (i.e., AOC-E2).

1.23.2 Potential Release Pathways

- **Surface Water and Sediments**

All storage operations are stopped and chemicals removed. During operation releases would have been contained in the building.

- **Soils**

These operations were indoors with secondary containment with little potential for direct soil contact. Seepage through the concrete floors is possible if the floor were compromised.

- **Groundwater**

Groundwater may have impacted from this AOC only if there were a release through the floor.

- **Air**

This pathway is negligible with the operation closed.

1.23.3 History of Releases, Investigations and Remediation

No documented releases to the surrounding environment are known to exist for this AOC.

To determine if the former hazardous waste recycling operation had impacted the environment, closure activities were initiated in December 1999.

The closure activities which are summarized in the report titled, "RCRA Closure Summary for Former Hazardous Waste Storage and Recycling Areas" included the following:

- Analysis of concrete floor of the former recycling area for the hazardous constituents listed under **40 CFR 264 Appendix IX**. The results of this analysis were used to finalize the list of constituents of concern (COCs) managed in this former recycling area.
- Analysis of the second concrete slab for all identified COCs by mass analysis and all metallic COCs by the E.P. Toxicity testing procedure. Discrete concrete samples were collected from beneath the cracks and gaps identified in the concrete floor surface of the recycling area.
- Analysis of subsurface soil directly beneath the second concrete slab sampled areas for all identified COCs by mass analysis and all metallic COCs by the E.P. Toxicity testing procedure.
- Analysis of concrete floor surface (discrete samples) of the former recycling area for all identified COCs by mass analysis and all metallic COCs by the E.P. Toxicity testing procedure.
- Comparison of the concrete and soil sampling results to the CT-DEP approved closure standards.

Based on the sampling results, approximately 5 cubic yards of concrete required removal and disposal to meet CT-DEP's approved closure standards. The site was certified as closed by HRP.

1.23.4 Data Gaps

- The site closure information will be compared to current RSRs to confirm conformance.

The closure activities for the Former NMP Recycling Area are summarized in the report entitled, "Closure Certification for the Former NMP Recycling Area" submitted by HRP Associates, Inc. in September 2002.

1.24 AOC-K3 Former Solder Stripper Recycling Area

1.24.1 Description of Unit Function, Components and Materials Managed

The former Solder Stripper Recycling Area was located in the northern end of the Gear Street Building and contained three (3) aboveground process tanks. The total capacity of these tanks was 5,000 gallons. This batch recycling operation was used to process 1,300 gallons of solder stripper at a time. Secondary containment was provided by an epoxy-coated concrete floor, building walls, and spill collection floor trench.

The floor trench, which has been removed from service, would direct any collected material to MacDermid's on-site industrial WWTS (i.e., AOC-E2).

1.24.2 Data Gaps

- None, this area has been closed per an approved RCRA closure plan and certified by a PE.

The closure activities for the Former Spent Solder Stripper Recycling Area are summarized in the report entitled, "Closure Certification for the Former NMP Recycling Area" submitted by HRP Associates, Inc. in September 2002. A copy of this report is included as Appendix G.

One groundwater monitoring well (SB-48/MW-128) will be installed downgradient of from the Former Spent Solder Stripper area.

The monitoring well will be installed and sampled as described in the site wide groundwater monitoring plan (see Section 1.2). Groundwater samples will be collected and analyzed for VOCs, SVOCs, TAL metals, cyanide, and Tin.

1.25 AOC K4 Gear Street Industrial Wastewater Sump Release

1.25.1 Description of Unit Function, Components and Materials Managed

This area is adjacent to AOC K-3 and AOC- I (1987 ink spill area). It consisted of a single spill in 2000 of untreated wastewater. The untreated wastewater was collected in a sump prior to discharge to the site WWTS. The sump overflowed.

1.25.2 Potential Release Pathways

- **Surface Water and Sediments**

All storage operations are stopped and chemicals removed. During operation releases would have been contained in the building.

- **Soils**

These operations were indoors with secondary containment with little potential for direct soil contact.

Seepage through the concrete floors is possible if the floor were compromised.

- **Groundwater**

Groundwater may have impacted from this AOC only if there were a release through the floor.

- **Air**

This pathway is negligible with the operation closed.

1.25.3 History of Releases, Investigations and Remediation

No documented releases to the surrounding environment are known to exist for this AOC.

To determine if the former hazardous waste recycling operation had impacted the environment, closure activities were initiated in December 1999. The closure activities which are summarized in the report titled, "RCRA Closure Summary for Former Hazardous Waste Storage and Recycling Areas" included the following:

- Analysis of concrete floor of the former recycling area for the hazardous constituents listed under **40 CFR 264 Appendix IX**. The results of this analysis were used to finalize the list of constituents of concern (COCs) managed in this former recycling area.
- Analysis of the second concrete slab for all identified COCs by mass analysis and all metallic COCs by the E.P. Toxicity testing procedure. Discrete concrete samples were collected from beneath the cracks and gaps identified in the concrete floor surface of the recycling area.
- Analysis of subsurface soil directly beneath the second concrete slab sampled areas for all identified COCs by mass analysis and all metallic COCs by the E.P. Toxicity testing procedure.
- Analysis of concrete floor surface (discrete samples) of the former recycling area for all identified COCs by mass analysis and all metallic COCs by the E.P. Toxicity testing procedure.
- Comparison of the concrete and soil sampling results to the CT-DEP approved closure standards.

Based on the sampling results, approximately 5 cubic yards of concrete required removal and disposal to meet CT-DEP's approved closure standards. The site was certified as closed by HRP.

1.25.4 Data Gaps

- The residual from the historical spill and remediation needs to be compared to current soil and groundwater RSRs.
- Continued evaluation of the site-wide groundwater system will better assess if there has been any residual impact to groundwater.

One groundwater monitoring well (SB-48/MW-128) will be installed downgradient of the industrial wastewater sump release area. The monitoring well will be installed and sampled as described in the site wide groundwater monitoring plan (see Section 1.2). Groundwater samples will be collected and analyzed for VOCs, SVOCs, TAL metals, cyanide, and Tin.

1.26 AOC K5 Ink Manufacturing Area

1.26.1 Description of Unit Function, Components and Materials Managed

This AOC is located in the southeastern side of the Gear Street Building. This area, which was comprised of tanks and roller mills, was used to prepare inks for the printed circuit board industry. The types of chemicals used in this area include: pigments, solvents, acrylimides, amines, and resins. No documented releases to the surrounding environment are known to exist for this AOC.

To prevent releases from entering the environment, this AOC is equipped with the following secondary containment provisions; epoxy-coated concrete floor, building walls, and wastewater collection sump. The material collected in the collection sump would be discharged to MacDermid's industrial WWTS (i.e., AOC-E2).

1.26.2 Potential Release Pathways

- **Surface Water and Sediments**

All storage operations are stopped and chemicals removed. During operation releases would have been contained in the building.

- **Soils**

These operations were indoors with secondary containment with little potential for direct soil contact. Seepage through the concrete floors is possible if the floor were compromised.

- **Groundwater**

Groundwater may have impacted from this AOC only if there were a release through the floor.

- **Air**

This pathway is negligible with the operation closed.

1.26.3 History of Releases, Investigations and Remediation

There are no known releases to this area. All operations have been stopped and chemicals removed. There is no existing downgradient groundwater monitoring wells from this AOC.

1.26.4 Data Gaps

- Presence of any cracks in the concrete with penetrations to the subsoil which would allow contamination by constituents of concern need to be assessed.
- Continued evaluation of the site-wide groundwater system will better assess if there has been any residual impact to groundwater.

To determine if there has been a release in Ink Manufacturing Area the concrete floor will be assessed visually. Based on visual assessment of the floor with in the Ink Manufacturing Area borings may be necessary (SB-41 and SB-42) to assess if a release has occurred.

Soil samples will be selected for chemical analysis from each boring based on greatest degree of contamination. The greatest degree of contamination will be identified by field screening of the borings with a PID and by visual observations.

Each sample will be analyzed for VOCs, SVOCs, RSR-15 metals, Cyanide and Tin. SPLP analysis will be done for metals on contingent basis if required to determine compliance with the GB PMC for other parameters.

Following the collection of subsurface soil samples, each subsurface soil boring will be abandoned by grouting the boring from the bottom of the boring to the top.

Groundwater samples will be collected as described in the current site wide groundwater sampling plan (see section 1.2). Groundwater samples will be collected and analyzed for VOCs, SVOCs, TAL metals, and cyanide and Tin.

1.27 AOC-K6 Electroless Nickel Area

1.27.1 Description of Unit Function, Components and Materials Managed

This AOC is located along the western side of the Gear Street Building. This area, which contained eight (8) process tanks with a capacity of up to 1,200 gallons (TRC, 1993), was used to manufacture electroless nickel plating solutions. The operations are closed and chemicals removed.

1.27.2 Potential Release Pathways

- **Surface Water and Sediments**

All manufacturing and storage operations are stopped and chemicals removed. During operation releases would have been contained in the building.

- **Soils**

These operations were indoors with secondary containment with little potential for direct soil contact. Seepage through the concrete floors is possible if the floor were compromised.

- **Groundwater**

Groundwater may have impacted from this AOC only if there were a release through the floor.

- **Air**

This pathway is negligible with the operation closed.

1.27.3 History of Releases, Investigations and Remediation

No documented releases to the surrounding environment are known to exist for AOC-K6. To prevent releases from entering the environment, this AOC is equipped with the following secondary containment provisions: epoxy-coated concrete floor, building walls, and wastewater collection sump. The material collected in the collection sump would be discharged to MacDermid's industrial WWTS (i.e., AOC-E2).

1.27.4 Data Gaps

- Presence of any cracks in the concrete with penetrations to the subsoil which would allow contamination by constituents of concern.
- Continued evaluation of the site-wide groundwater system will better assess if there has been any residual impact to groundwater.

To determine if there has been a release in Electroless Nickel Area the concrete will be assessed visually. Based on visual assessment of the floor within the Electroless Nickel Area borings may be necessary (SB-45 and SB-46) to assess if a release has occurred.

Soil samples will be selected for chemical analysis from each boring based on greatest degree of contamination. The greatest degree of contamination will be identified by field screening of the borings with a PID and by visual observations.

Each sample will be analyzed for VOCs, TAL metals, Cyanide, ETPH and Tin. SPLP analysis will be done for metals on a contingent basis if required to determine compliance with the GB PMC for other parameters.

Following the collection of subsurface soil samples, each subsurface soil boring will be abandoned by grouting the boring from the bottom of the boring to the top.

Groundwater samples will be collected as described in the current site wide groundwater sampling plan (see section 1.2.). Groundwater samples will be collected and analyzed for VOCs, SVOCs, TAL metals, cyanide, and Tin.

1.28 AOC K7 Satellite Storage Areas

1.28.1 Description of Unit Function, Components and Materials Managed

Located with AOC-I are three (3) hazardous waste satellite storage areas.

The satellite storage areas are located in the former **Solder Stripper Recycling Area**, in the **Ink Manufacturing Area** and **immediately west** of the Ink Manufacturing Area. Located within each satellite storage area were a maximum of two (2) 55-gallon drums, which are used to temporarily store the hazardous waste generated in the area.

When each drum was full, it was transferred to MacDermid's ≤ 90 day container storage area (i.e., AOC-K8). In the 1999 "Hazardous Waste Part B Permit Application Renewal" a total of five satellite accumulation areas were described.

1.28.2 Potential Release Pathways

- **Surface Water and Sediments**

All storage operations are stopped and chemicals removed. During operation, releases would have been contained in the building.

- **Soils**

These operations were indoors with secondary containment with little potential for direct soil contact. Seepage through the concrete floors is possible if the floor were compromised.

- **Groundwater**

Groundwater may have impacted from this AOC only if there were a release through the floor.

- **Air**

This pathway is negligible with the operation closed.

1.28.3 History of Releases, Investigations and Remediation

No documented releases to the surrounding environment are known to exist for AOC-K7. To prevent releases from entering the environment, this AOC is equipped with the following secondary containment provisions: epoxy-coated concrete floor, building walls, and wastewater collection sump. The material collected in the collection sump would be discharged to MacDermid's industrial WWTS (i.e., AOC-E2).

1.28.4 Data Gaps

- Presence of any cracks in the concrete with penetrations to the subsoil which would allow contamination by constituents of concern.
- Continued evaluation of the site-wide groundwater system will better assess if there has been any residual impact to groundwater.

To determine if there has been a release in any of the three (3) hazardous waste satellite storage areas the concrete will be assessed visually. Based on visual assessment of the floor within the satellite storage areas, borings may be necessary (SB-47, SB-48 and SB-49) to assess if a release has occurred.

Soil samples will be selected for chemical analysis from each boring based on greatest degree of contamination. The greatest degree of contamination will be identified by field screening of the borings with a PID and by visual observations

Each sample will be analyzed for VOCs, RSR-15 metals, Cyanide, ETPH and Tin. SPLP analysis will be done for metals on a contingent basis if required to determine compliance with the GB PMC for other parameters.

Following the collection of subsurface soil samples, each subsurface soil boring will be abandoned by grouting the boring from the bottom of the boring to the top.

Groundwater samples will be collected as described in the current site wide groundwater sampling plan (see section 1.2). Groundwater samples will be collected and analyzed for VOCs, SVOCs, TAL metals, cyanide and Tin.

1.29 AOC K8 Chemical Storage Area

1.29.1 Description of Unit Function, Components and Materials Managed

This AOC, which is located in the southern end of the Gear Street Building and consists of the less than 90 day hazardous waste storage area and the Chemical Storage Area. The Chemical Storage Area is the former Combustible Storage Area. The Combustible Closure Area was RCRA regulated and closed circa 1999.

The less than 90 day hazardous waste storage area measured approximately 40 feet long by 20 feet wide. Secondary containment for this hazardous waste storage area is provided by an epoxy-coated concrete floor and 4" high epoxy-coated angle-iron. The Chemical Storage Area (former Combustible Storage Area) was designed to store up to fifty-four (54) 55-gallon drums and four (4) 330-gallon storage totes. Secondary containment for this storage area was provided by an epoxy-coated concrete floor and 4" high epoxy-coated angle-iron.

1.29.2 Potential Release Pathways

- **Surface Water and Sediments**

All storage operations are stopped and chemicals removed. During operation releases would have been contained in the building.

- **Soils**

These operations were indoors with secondary containment with little potential for direct soil contact. Seepage through the concrete floors is possible if the floor were compromised.

- **Groundwater**

Groundwater may have impacted from this AOC only if there were a release through the floor.

- **Air**

This pathway is negligible with the operation closed.

1.29.3 History of Releases, Investigations and Remediation

No documented releases to the surrounding environment are known to exist for AOC-K8. To prevent releases from entering the environment, this AOC is equipped with the following secondary containment provisions: epoxy-coated concrete floor, building walls, and wastewater collection sump.

The material collected in the collection sump would be discharged to MacDermid's industrial WWTS (i.e., AOC-E2). The former Combustible storage area was closed circa 1999; however, detailed information of this closure was not available.

1.29.4 Data Gaps

- The documentation for the closure of the former combustible storage area under RCRA is not clear. The past closure means and methods need to be compared against current guidance.

To determine if there has been a release in the Chemical Storage Areas the concrete will be assessed visually, Chip sampling will be performed and two borings (SB-43 and SB-44) will be placed in the area. Chip sampling will be performed following procedures as described in the QAPP. A carbide bit drill will be used on a rotary impact hammer drill to create dust to collect for samples. The chip samples will be analyzed for VOCs, RSR-15 metals, Cyanide, ETPH, and Tin.

Soil samples will be selected for chemical analysis from each boring based on greatest degree of contamination. The greatest degree of contamination will be identified by field screening of the borings with a PID and by visual observations.

Each sample will be analyzed for VOCs, RSR-15 metals, Cyanide, ETPH, and Tin. SPLP analysis will be done for metals on a contingent basis if required to determine compliance with the GB PMC for other parameters.

Following the collection of subsurface soil samples, each subsurface soil boring will be abandoned by grouting the boring from the bottom of the boring to the top.

Groundwater samples will be collected as described in the current site wide groundwater sampling plan (see section 1.2). Groundwater samples will be collected and analyzed for VOCs, SVOCs, TAL metals, cyanide and Tin.

1.30 AOC L Transformer Vault

1.30.1 Description of Unit Function, Components and Materials Managed

This AOC is located on the south side of the Gear Street Building. This 4'x4'x4' steel transformer vault is located on a concrete pad.

1.30.2 Potential Release Pathways

- **Surface Water and Sediments**

Surface water and sediments would be impacted only if there was leakage from the transformer to a storm drain. This is remote given there are no storm drains in the immediate area.

- **Soils**

Seepage through the concrete or asphalt from leakage could impact underlying soils.

- **Groundwater**

Groundwater may have impacted from this AOC only if there were a release through the pavement.

- **Air**

This pathway is negligible unless there was a fire that consumed the transformer.

1.30.3 History of Releases, Investigations and Remediation

No documented releases to the surrounding environment are known to exist for AOC-L. Releases from this AOC may potentially occur if the structural integrity of the steel transformer is impacted.

1.30.4 Data Gaps

- Assess the presence of any cracks in the concrete and asphalt with penetrations to the subsoil which would allow contamination by constituents of concern.
- Evaluate the soil quality around the transformers to assess for the potential of a historical release.

To determine if there has been a release in the area of the Transformer Vault the concrete will be assessed visually and two borings (SB-39 and SB-40) will be placed in the area. The borings will be drilled using a Geoprobe direct push drill rig to below the depth of any apparent contamination or waste material.

Soil samples will be selected for chemical analysis from each boring based on greatest degree of contamination. The greatest degree of contamination will be identified by field screening of the borings with a PID and by visual observations.

Each sample will be analyzed for VOCs, RSR-15 metals, PCBs, Cyanide, ETPH and Tin. SPLP analysis will be done for metals on a contingent basis if required to determine compliance with the GB PMC for other parameters.

Following the collection of subsurface soil samples, each subsurface soil boring will be abandoned by grouting the boring from the bottom of the boring to the top.

One groundwater monitoring well (MW-130) will be installed downgradient of the Transformer Vault. The monitoring well will be installed and sampled as described in the site wide groundwater monitoring plan (see Section 1.2). Groundwater samples collected from the well will be analyzed for VOCs, TAL metals, ETPH, PCBs, Cyanide and Tin.

1.31 Reporting

GEI will submit a report of findings from the initial scope of work by July 30, 2008. This report will include the following:

- Detailed summary of work completed
- Evaluation of findings
- Modifications to the site conceptual model based on new data
- Recommendations for additional work and/or interim measures (IM), including an IM work plan
- Details of any new release areas discovered (EPA and CTDEP will notified within 15 days of any new releases)
- Revisions to the schedule

Tables

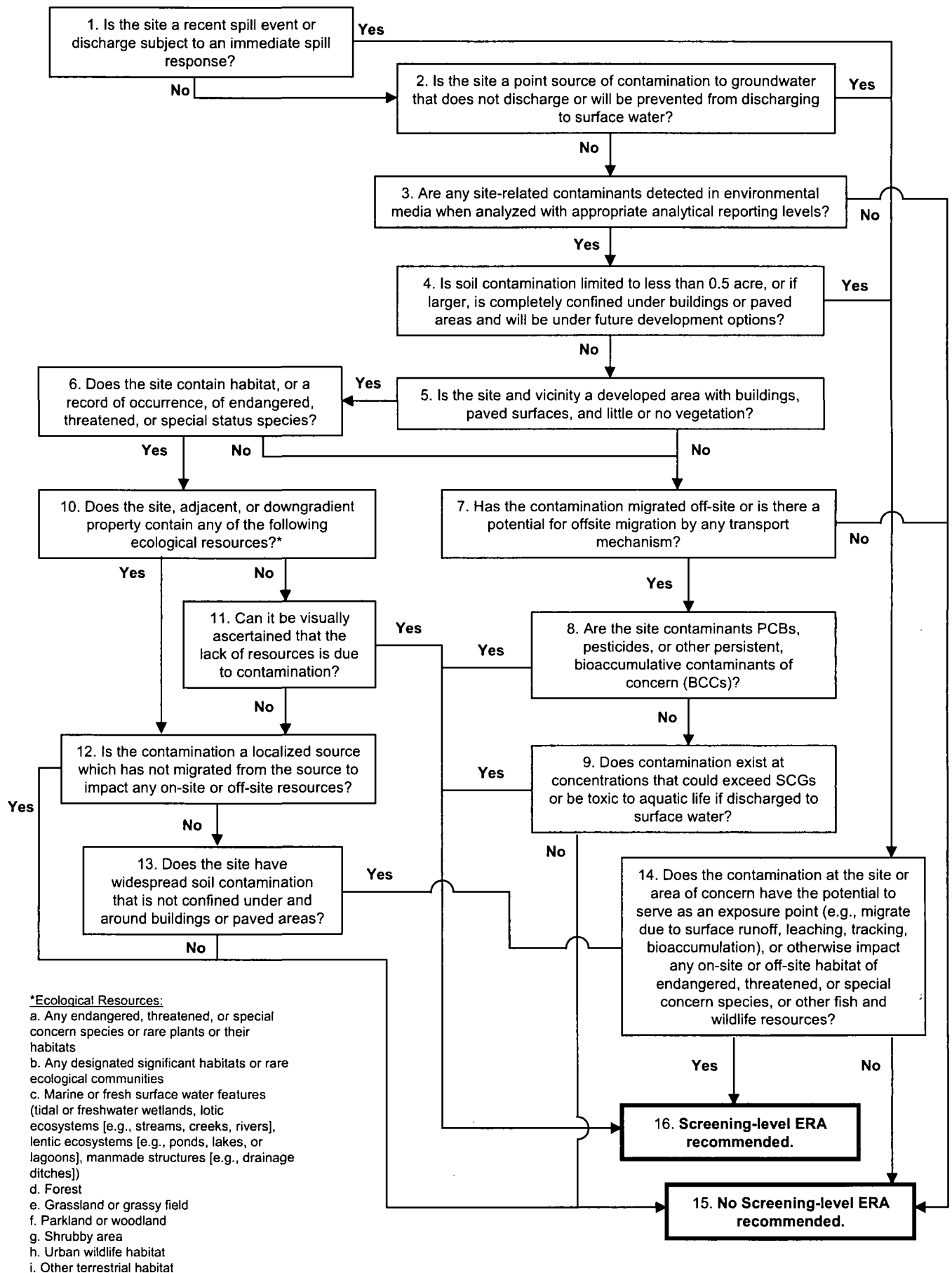


Table 1
Summary of Analytical Samples - Solids
MacDermid, Inc.
526 Huntingdon Avenue
Waterbury, Connecticut

Solids Samples

			COCs									
Sample ID	Location	AOCs Covered	VOCs Method 8260	SVOCs Method 8270	Metals Method 6010/7470 *	Cyanide Method 9010	ETPH Method CTETPH	PCBs Method 8082	Waste Char. Method Varies **	Rationale	Percent Completeness Goals	
SB-1	North Parcel - Cap	AOC-A	2		2	2	2			Characterize Material and Volume of Material	1 missed sample - 93	
SB-2			1		1	1	1					
SB-3									2			
SB-4									2			
SB-5			2		2	2	2					
SB-6			1		1	1	1					
SB-7 to SB-15***	North Parcel - Soil Piles		4		4	4	4					
SB-16	Adjacent to AOC-B (UST) and Huntingdon Ave.	AOC-B	1	1			1			Confirm or Deny Release	100	
MW-119	Down-gradient of AOC-C (Dry Chemical Silos), Adjacent to East Aurora Street	AOC-B, AOC-C	2	2	2	2						
SB-17	Adjacent to AOC-F (6,000 gal. UST)	AOC-F	1				1			Confirm or Deny Release	100	
SB-18			1				1					
SB-50	Huntingdon Ave. Building, Pilot Plant, QA/QC Labs, Small Packaging Area, Satellite Hazardous Waste Container Storage Area	AOC-D1	1		1	1	1			Confirm or Deny Release		
SB-51			1		1	1	1					
SB-52			2		2	2	2					
SB-19	Huntingdon Ave. Building, Main mixing area	AOC-D2	1		1	1	1			Confirm or Deny Release	100	
SB-20			1		1	1	1					
SB-21			1		1	1	1					
Chip Sampling***			4		4	4	4					
SB-22	Huntingdon Ave. Building, Spent copper etchant recycling area	AOC-E	2		2	2	2			Confirm or Deny Release	100	
SB-23			1		1	1	1					
SB-24	Adjacent to AOC-E 1 (Sample House/Former WWTS)	AOC-D, AOC-E	2		2	2	2			Confirm or Deny Release	100	
SB-25	Huntingdon Ave. Building, AOC-E	AOC-E			1	1	1		2	1. Confirm or Deny Release 2. Delineate Extent of Formar Lagoon	2 missed samples = 87.5	
SB-26			1		1	1	1					
SB-27			1		1	1	1					
SB-28									2			
SB-29			1		1	1	1					
SB-30			2		2	2	2					
SB-31			1		1	1	1					
SB-32			2		2	2	2					
SB-33			1		1	1	1					
SB-34			1		1	1	1					
SB-35			2		2	2	2					
SB-36			1		1	1	1					
MW-122			2		2	2	2					
MW-123			1		1	1	1					
MW-124			2		2	2	2					
MW-125			1		1	1	1					
MW-126	East Aurora Street Warehouse		1		1	1	1		Confirm or Deny Release	100		
MW-127		1		1	1	1						
SB-37	AOC-H (Former Flammable Material Rack Storage Area)	AOC-H	1		1		1		Confirm or Deny Release	100		
SB-38			1		1		1					
MW-129	Downgradient of AOC-J	AOC-J	2		2	2	2			Residual after closure.	100	
SB-39	Adjacent to AOC-L, West	AOC-L	1		1	1	1	1		Confirm or Deny Release	100	
SB-40	Adjacent to AOC-L, East		1		1	1	1	1				
SB-41	Gear Street building, Ink manufacturing area	AOC-K5	1	1	1	1				Confirm or Deny Release	100	
SB-42			1	1	1	1						
SB-43	Gear Street building, Chemical storage area	AOC-K8	2		2	2	2			Confirm or Deny Release	100	
SB-44			1		1	1	1					
Chip Sampling***			4		4	4	4					
SB-45	Gear Street building, Electroless Nickel Area	AOC-K6	2		2	2	2			Confirm or Deny Release	100	
SB-46			1		1	1	1					
SB-47	Gear Street building, Hazardous waste storage areas	AOC-I/K7	1		1	1	1			Confirm or Deny Release	100	
SB-48/MW-128			2		2	1	2	2				
SB-49			1		1	1	1					
Totals			74	5	71	68	70	4	8		100.0	

Notes:

Sample IDs in bold indicate proposed sample locations.

* Detections of metals via Method 6010 and or 7470 will determine need to perform Synthetic Precipitate Leaching Procedure (SPLP). Metals tested include: Copper, Lead, Tin, Silver, Arsenic, Mercury, Cyanide, Barium, Cadmium, Nickel, Chromium, Zinc, Beryllium, Antimony, Selenium, Thallium, and Vanadium. For budget purposes, 50% of total metals analysis will also be analyzed via SPLP extraction.

** Waste characteristic analytical requirements are subject to requirements of disposal facility. For budget purposes analysis will include flashpoint, reactivity, ETPH, TCLP metals, PCBs (mass), VOCs (mass), and pH.

*** Number of samples taken/analyzed may vary depending on size of area and/or amount of material. For budget purposes assume 4 samples per area.

Trip blanks will be collected and analyzed at a rate of 1 sample per cooler per day. Trip blanks are analyzed via Method 8260 and are performed at no charge to the client.

Field duplicates and equipment blanks are both performed at a rate of 5 percent per matrix (i.e. groundwater, soil) per analytical method.

Table 2
Summary of Analytical Samples - Groundwater
MacDermid, Inc.
526 Huntingdon Avenue
Waterbury, Connecticut

Groundwater Samples

Sample ID	Location	AOCs Covered	COCs						Rationale	Percent Completeness Goals
			VOCs Method 8260	SVOCS Method 8270	Metals Method 6010/7470 *	Cyanide Method 9010	ETPH CTETPH	PCBs Method 8082		
MW-101	North Parcel - Upgradient	AOC-A	1		1	1	1		Characterize Material and Volume of Material	100
MW-102	North Parcel - Downgradient		1		1	1	1			
MW-103	North of AOC-C	AOC-B	1		1		1	1	Confirm or Deny Release	100
MW-119	Downgradient of AOC-C, Adjacent to East Aurora Street	AOC-B, AOC-C	1	1	1	1			Confirm or Deny Release	100
MW-104	Downgradient of AOC-F	AOC-F	1			1	1		Confirm or Deny Release	100
MW-105			1			1	1			
MW-120	Huntingdon Ave. Building, Main mixing area	AOC-D2	1	1	1	1			Confirm or Deny Release	100
MW-121	Adjacent to AOC-E (Sample House)	AOC-D, AOC-E	1	1	1	1			Confirm or Deny Release	100
MW-110	Downgradient AOC-E (Sample House)		1	1	1	1				
MW-109	Huntingdon Ave. Building, AOC-E	AOC-E	1	1	1	1			1. Confirm or Deny Release. 2. Delineate Extent of Former Lagoon.	90
MW-107			1	1	1	1				
MW-108			1	1	1	1				
MW-122			1		1	1	1			
MW-123			1		1	1	1			
MW-124			1		1	1	1			
MW-125			1		1	1	1			
MW-126	AOC-G adjacent to East Aurora Street	AOC-G	1	1	1	1			1. Residual after closure. 2. Ambient Groundwater Quality.	90
MW-127	AOC-G adjacent to East Aurora Street		1	1	1	1				
MW-111	East of AOC-G (Former Finished Product Storage Area)		1	1	1	1				
MW-114	East of AOC-G (Former Finished Product Storage Area), adjacent to East Aurora Street		1	1	1	1				
MW-115	Corner between Former Finished Product Storage Area and Former Rack Storage Area		1	1	1	1				
MW-115D	Corner between Former Finished Product Storage Area and Former Rack Storage Area	AOC-G, Site wide	1	1	1	1			Ambient Groundwater Quality	
MW-117S	Adjacent to Gear Street, West of AOC-H; Shallow	AOC-H, Site wide	1	1	1	1			Ambient Groundwater Quality, Up-gradient (Adjacent to Residential Area)	90
MW-117D	Adjacent to Gear Street, West of AOC-H; Deep		1	1	1	1				
MW-116S	Adjacent to Gear Street, West of AOC-H; Shallow		1	1	1	1				
MW-116D	Adjacent to Gear Street, West of AOC-H; Deep		1	1	1	1				
MW-118S	Adjacent to Gear Street, Southwest of AOC-H; Shallow		1	1	1	1				
MW-118D	Adjacent to Gear Street, Southwest of AOC-H; Deep		1	1	1	1				
MW-112	Upgradient of AOC-K/ AOC-I		1	1	1	1				
SB-48/MW-128	Adjacent to AOC-I (Downgradient)	AOC-I	1	1	1	1			Residual after closure.	100
MW-129	Downgradient of AOC-J	AOC-J	1	1	1	1	1		Residual after closure.	100
MW-113	Corner of East Aurora Street and Gear Street	AOC-K	1	1	1	1			1. Residual after closure. 2. Ambient Groundwater Quality.	100
MW-130	Downgradient to AOC-L	AOC-L, Site wide	1		1	1		1	Confirm or Deny Release	
Totals			33	23	31	32	10	2		97.5

Notes:

Sample IDs in bold indicate proposed sample locations.

Metals for groundwater will be analyzed for target analyte list (TAL) which include Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Ti, V, Zn.

Trip blanks will be collected and analyzed at a rate of 1 sample per cooler per day. Trip blanks are analyzed via Method 8260 and are performed at no charge to the client.

Field duplicates and equipment blanks are both performed at a rate of 5 percent per matrix (i.e. groundwater, soil) per analytical method.

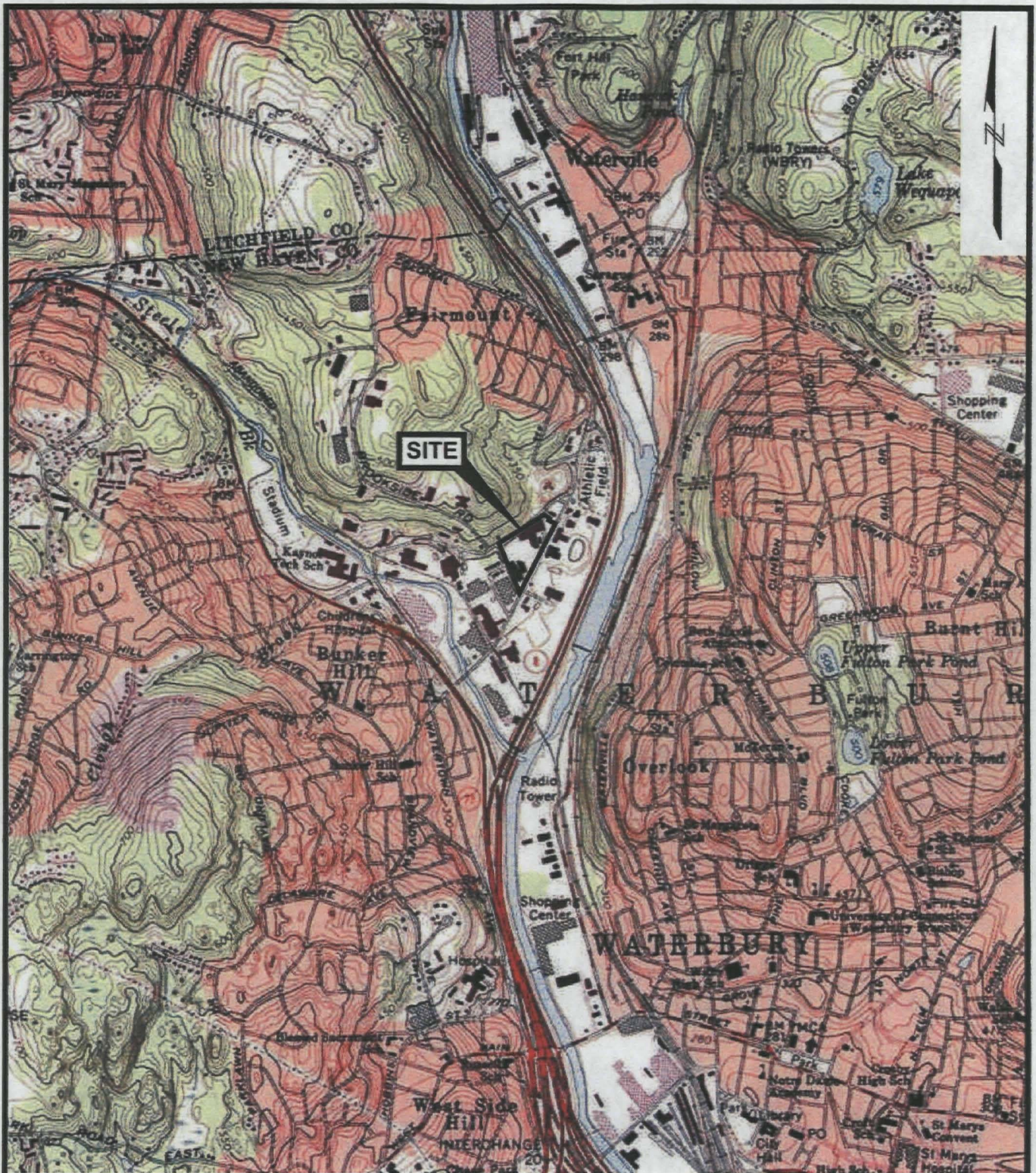
Table 3
Conceptual Site Model
MacDermid, Inc.
526 Huntingdon Avenue
Waterbury, Connecticut

Areas of Concern	Description of AOC	Source	Release Mechanism	Sampling Objectives	# of Borings Proposed	# of Wells Existing/Proposed	Matrix	Contaminants of Concern
AOC-A	North Parcel	Soil and/or sludge materials from former waste lagoons	Transport of lagoon sludge and/or contaminated soil to consolidation area	Assess the effectiveness of the current GW monitoring system		MW-101, MW-102	Groundwater	TAL Metals, VOCs, Cyanide, TIN, ETPH
				Assess the amount of material stored under cap	SB-1, SB-2, SB-5, SB-6		Soil	VOCs, RSR -15 Metals, Cyanide, Tin, ETPH (all) Waste Characterization (SB-3 & SB-4)
	Soil Disposal Area	Unknown	Potentially contaminated soil exposed to the environment	Assess type of material stored under cap	SB-3 & SB-4		Soil	VOCs, RSR -15 Metals, Cyanide, Tin, ETPH
AOC-B	Underground Storage Tank	Tank contents (No. 2 fuel)	Storage tank failure resulting in direct release to the environment	Assess if there has been a failure from the tank and a release to the surrounding environment	SB-16	MW-103	Soil	VOCs, ETPH
							Groundwater	VOCs, TAL Metals, ETPH, PCBs
AOC-C	Dry Chemical Silos	Chemical silo contents (i.e. sodium carbonate, sodium hydroxide, sodium metasilicate, anhydrous sodium hydroxide)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through concrete floor	Assess if a release has occurred	MW-119	MW-119	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin, monitor pH
							Soil	VOCs, RSR -15 Metals, Cyanide, Tin, ETPH
AOC-D1 and D2	Pilot Plant (AOC-D1)	Chemicals used during operation (i.e. copper etchant, solder stripper, inks, electroless nickel plating solution, dry batch chemicals)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through concrete floor	Establish if there has been a release through the concrete floor	SB-19, SB-20, SB-21, SB-50, SB-51, SB-52, Chip Sampling	MW-120	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin
	Main Mixing Area (AOC-D2)						Soil	VOCs, RSR -15 Metals, Cyanide, Tin, ETPH
AOC-E1	Former Waste Lagoons and LNAPL	Former contents of lagoons (i.e. metal hydroxide, metals, cyanide, and industrial solvents)	Percolation of unlined lagoon contents into underlying soils	Assess if there is any residual waste in the buried lagoons. Estimate horizontal and vertical extent of residual waste in the buried lagoons. Assess the degree and extent of LNAPL in MW-108.	SB-22, SB-23, SB-24 SB-25, SB-26, SB-27, SB-28, SB-29, SB-30, SB-31, SB-32, SB-33, SB-34, SB-35, SB-36, MW-122, MW-123, MW-124, MW-125	MW-107, MW-108, MW-109, MW-110, MW-121, MW-122, MW-123, MW-124, MW-125	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin (MW-107, MW-108, MW-109, MW-110, MW-121) VOCs, TAL Metals, Cyanide, Tin, ETPH (MW-122, MW-123, MW-124, MW-125)
AOC-E2	Wastewater Treatment System (WWTS)	Former contents of lagoons (i.e. metal hydroxide, metals, and industrial solvents)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through concrete floor					
AOC-E3	Spent Copper Etchant Storage Area	Process chemicals (i.e. ammonia, arsenic, chloride, copper chromium, lead, nickel, tin, and zinc)	Spillage during handling operations and failure of storage tank resulting in migration of stored chemicals through concrete floor					
AOC-E4	Spent Copper Etchant Recycling Area	Process chemicals (i.e. ammonia, arsenic, chloride, copper chromium, lead, nickel, tin, and zinc)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through concrete floor				Soil	VOCs, RSR -15 Metals, Cyanide, Tin, ETPH (18) Waste Characterization (SB-28)
AOC-E5	Acid Tank Farm	Bulk acid storage (i.e. hydrochloric acid, nitric acid, hydrogen peroxide, and sulfuric acid)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through concrete floor					
AOC-E6	1994 Spent Copper Etchant Spill	Process chemicals (i.e. ammonia, arsenic, chloride, copper chromium, lead, nickel, tin, and zinc)	Documented release of contents to Steele Brook via the stormwater collection system					
AOC-F	Former 6,000 Gallon UST (East Aurora Street Building)	Tank contents (No. 2 fuel)	Storage tank failure resulting in direct release to the environment	Determine if there has been a release from the UST	SB-17, SB-18	MW-104, MW-105	Groundwater	VOCs, TAL Metals, Cyanide, Tin, ETPH
							Soil	VOCs, ETPH

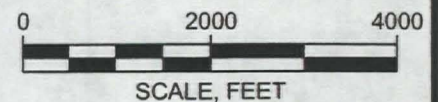
Table 3
Conceptual Site Model
MacDermid, Inc.
526 Huntingdon Avenue
Waterbury, Connecticut

Areas of Concern	Description of AOC	Source	Release Mechanism	Sampling Objectives	# of Borings Proposed	# of Wells Existing/Proposed	Matrix	Contaminants of Concern
AOC-G	East Aurora Street Warehouse	Process chemicals (i.e. ammonia, arsenic, chloride, copper chromium, lead, nickel, tin, and zinc)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through concrete floor	Assess if there has been a release to the groundwater		MW-111, MW-114, MW-115, MW-115D, MW-126, MW-127	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin
AOC-H	Flammable Material Rack Storage Area	Process chemicals (i.e. alcohols, toluene, xylene, additional solvents)	Spillage during handling operations and failure of storage tank resulting in direct release to the environment	Determine if there has been a release in the Flammable Material Rack Storage Area	SB-37 SB-38	MW-112, MW-116S, MW-116D, MW-117S, MW-117D, MW-118S, MW-118D	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin
							Soil	VOCs, RSR -15 Metals, Tin, ETPH
AOC-I	Ink Spill Area	Epoxy-like ink material (contents aromatic ketones, acrylic monomers, metals)	Documented release migrating through concrete pad	Assess if the groundwater has been impacted from the Ink spill		MW-128	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin
AOC-J	4,000 Gallon UST (Gear Street Building)	Tank contents (No.2 fuel)	Storage tank failure resulting in direct release to the environment	Assess if the groundwater in the area of the UST has been impacted	MW-129	MW-129	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin, ETPH
							Soil	VOCs, RSR -15 Metals, Tin, Cyanide, ETPH
AOC-K1	Former Flammable Storage Area	Process chemicals (i.e. ethyl ketone, toluene, xylene, additional solvents)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through concrete floor	Assess if the groundwater in the area has been impacted		MW-113	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin
AOC-K2	Former NMP Recycling Area		Spillage during handling operations and failure of storage tank resulting in migration of stored chemicals through concrete floor					
AOC-K3	Former Solder Stripper Recycling Area	Process chemicals (i.e. tin, lead, zinc, and copper)	Spillage during handling operations and failure of storage tank resulting in migration of stored chemicals through concrete floor					
AOC-K4	Gear Street Industrial Wastewater Sump Release	Industrial wastewater	Documented release resulting in migration through concrete floors					
AOC-K5	Ink Manufacturing Area	Process ink (i.e. pigments, solvents, acrylimides, and resins)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through secondary containment and concrete floor	Determine if there has been a release in the Ink Manufacturing Area	SB-41, SB-42		Soil	VOCs, SVOCs, RSR -15 Metals, Tin, Cyanide
AOC-K6	Electroless Nickel Area	Process chemicals (i.e. nickel compounds, sodium compounds, and phosphites)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through secondary containment and concrete floor	Determine if there has been a release to in the Electroless Nickel Area	SB-45, SB-46		Soil	VOCs, RSR -15 Metals, Tin, Cyanide, ETPH
AOC-K7	Satellite Storage Areas	Various hazardous wastes (i.e. solvent, metals, and acids)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through secondary containment and concrete floor	Determine if there has been a release in any of the three Satellite Storage Areas	SB-47, SB-48, SB-49		Soil	VOCs, RSR -15 Metals, Tin, Cyanide, ETPH
AOC-K8	Chemical Storage Area	Various chemical wastes (i.e. solvent, metals, and acids)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through secondary containment and concrete floor	Determine if there has been a release in the Chemical Storage Areas	SB-43, SB-44, Chlp Sampling		Soil	VOCs, RSR -15 Metals, Tin, Cyanide, ETPH
AOC-L	Transformer Vault	Transformer fluid and components	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through secondary containment and concrete floor	Determine if there has been a release from the transformer	SB-39, SB-40	MW-130	Groundwater	VOCs, TAL Metals, Cyanide, Tin, ETPH, PCBs
				Determine if the groundwater has been impacted in the area of the Transformer Vault			Soil	VOCs, RSR -15 Metals, Tin, Cyanide, ETPH, PCBs

Figures



SOURCE: Map created with TOPO!® ©2001 National Geographic
 (www.nationalgeographic.com/topo)



MacDERMID, INC.
 526 HUNTINGDON AVENUE
 WATERBURY, CONNECTICUT

MacDERMID, INC.
 WATERBURY, CONNECTICUT

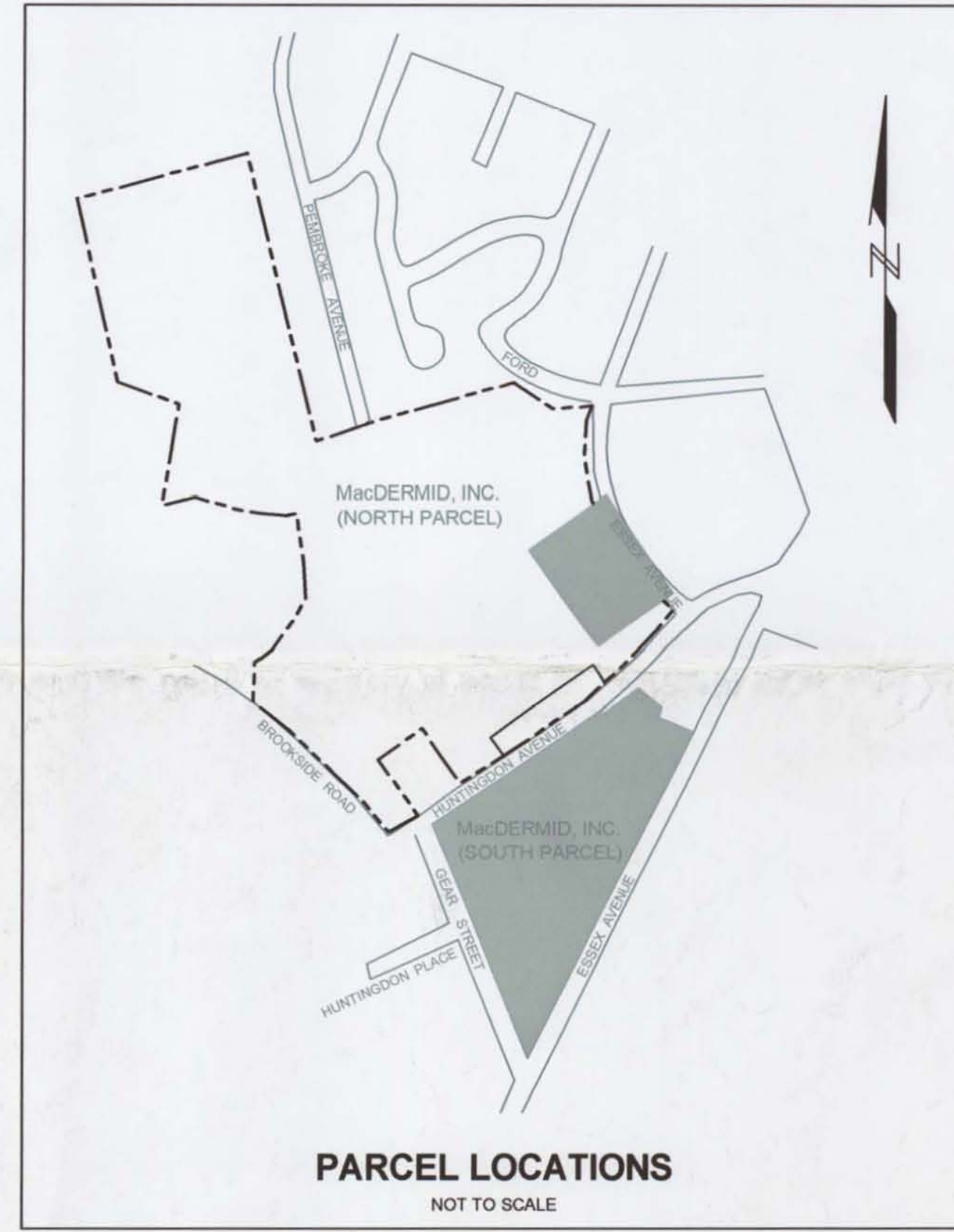
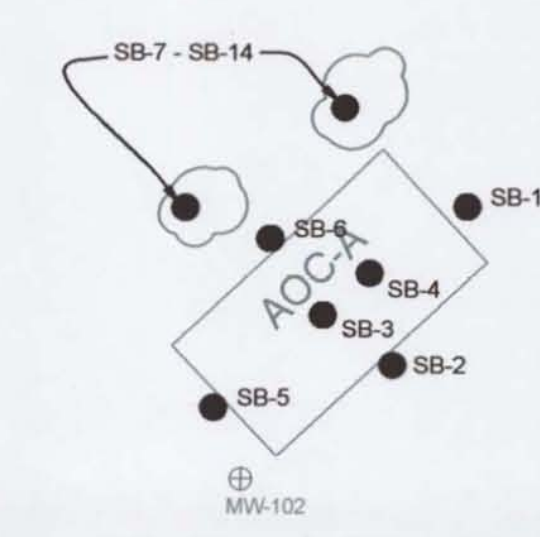
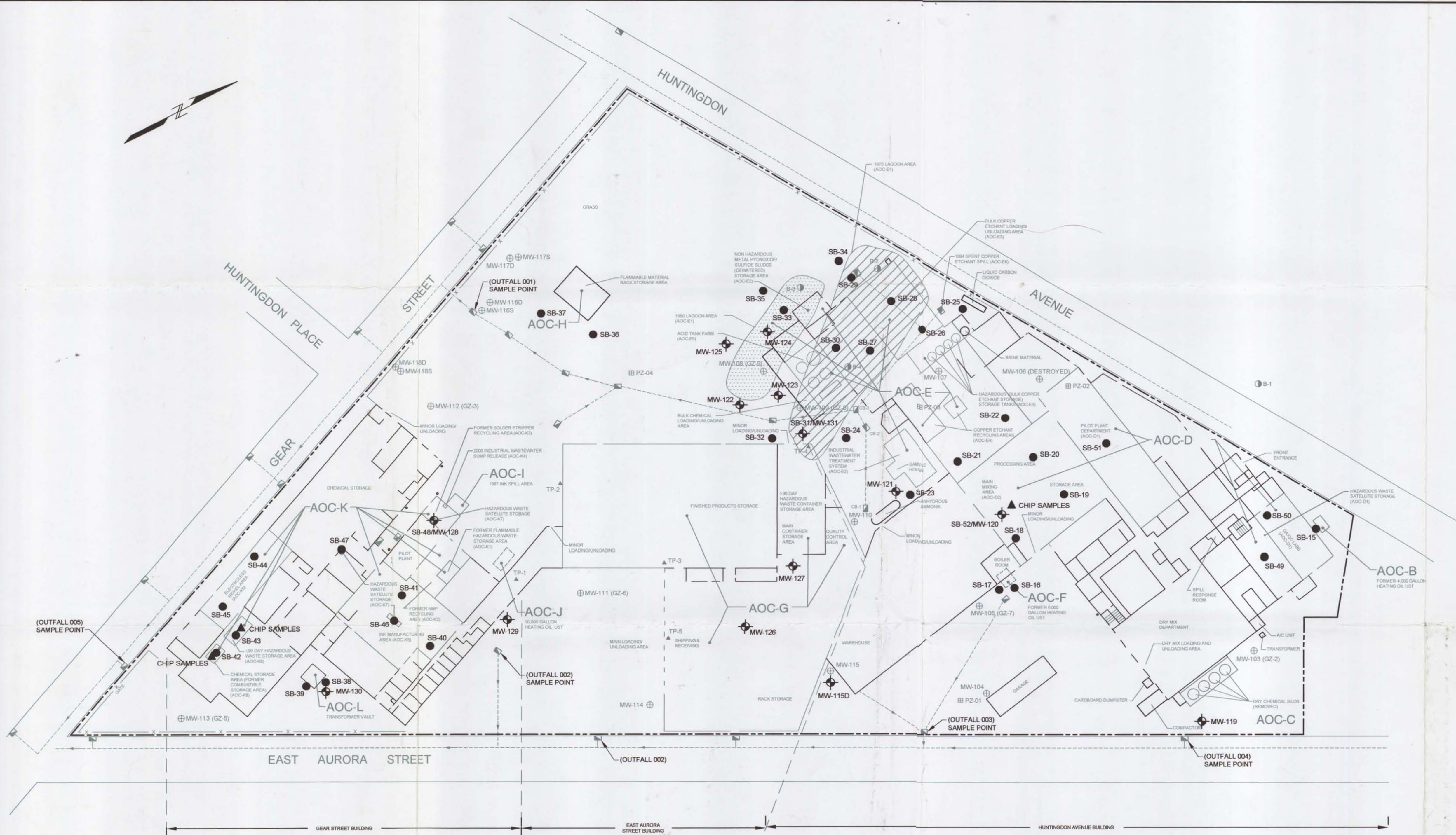


Project 073290-1000

SITE LOCATION MAP

April 2008

Figure 1

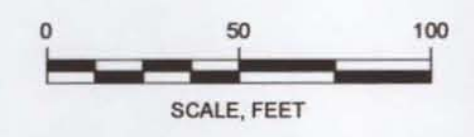


LEGEND

- MW-119 - PROPOSED MONITORING WELL
- SB-1 - PROPOSED SOIL BORING
- CHIP SAMPLES - PROPOSED CHIP SAMPLING LOCATION
- GROUNDWATER MONITORING WELL
- CATCH BASIN/STORM DRAIN
- 1995 TEST BORING
- 1985 SOIL TEST PIT (APPROXIMATE LOCATION)
- 1975 LAGOON AREA (APPROXIMATE LOCATION), AOC-E1
- 1980 LAGOON AREA (APPROXIMATE LOCATION), AOC-E1
- PIEZOMETER
- POSSIBLE LOCATION OF SOIL PILE

SOURCE:

1. PLAN BASED ON MAP PREPARED BY HRP ASSOCIATES, INC., PLAINVILLE, CT
 TITLED AREAS OF CONCERN (AOC) AND RSR EXCEEDANCES, MacDERMID, INC., 526 HUNTINGDON AVENUE, WATERBURY, CONNECTICUT, DATED FEBRUARY 2005.



MONITORING WELL	FORMER MONITORING WELL DESIGNATION	DATE OF INSTALLATION	TYPE OF WELL	SCREEN DEPTH	STATUS
MW-101	MAC-6	4/2/86	BEDROCK	28-36'	ACTIVE
MW-102	MAC-5	3/31/86	SHALLOW OVERBURDEN	22-32'	ACTIVE
MW-103	GZ-2	1/12/95	SHALLOW OVERBURDEN	25-35'	ACTIVE
MW-104	MAC-7	UNKNOWN	SHALLOW OVERBURDEN	UNKNOWN	INACTIVE (CLOGGED)
MW-105	GZ-7	2/15/95	SHALLOW OVERBURDEN	27-37'	ACTIVE
MW-106	MAC-4	UNKNOWN	SHALLOW OVERBURDEN	UNKNOWN	INACTIVE (LOST)
MW-107	MAC-3	UNKNOWN	SHALLOW OVERBURDEN	UNKNOWN	INACTIVE (CLOGGED)
MW-108	GZ-9	2/16/95	SHALLOW OVERBURDEN	25-35'	ACTIVE
MW-109	GZ-8	2/15/95	SHALLOW OVERBURDEN	25-35'	ACTIVE
MW-110	MAC-1	UNKNOWN	SHALLOW OVERBURDEN	UNKNOWN	ACTIVE
MW-111	GZ-6	1/13/95	SHALLOW OVERBURDEN	25-35'	ACTIVE
MW-112	GZ-3	1/13/95	SHALLOW OVERBURDEN	25-35'	ACTIVE
MW-113	GZ-5	1/13/95	SHALLOW OVERBURDEN	30-40'	ACTIVE

MacDERMID, INC.
 526 HUNTINGDON AVENUE
 WATERBURY, CONNECTICUT

MacDERMID, INC.
 WATERBURY, CONNECTICUT

PROJECT 073290-1000



SITE LAYOUT AND PROPOSED SAMPLE LOCATIONS

Appendix A

QAPP



Geotechnical
Environmental and
Water Resources
Engineering

Quality Assurance Project Plan (QAPP)

MacDermid Incorporated

526 Huntingdon Avenue, Waterbury Connecticut

USEPA ID# CTD001164599

Permit # DEP/HWM/CS-151-001

Submitted to:

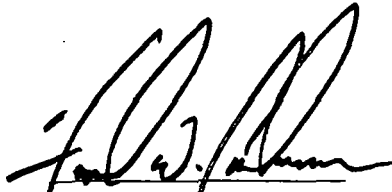
John Cordani
General Counsel/Corporate Secretary
MacDermid Incorporated
245 Freight Street
Waterbury, CT 06702

Submitted by:

GEI Consultants, Inc.
455 Winding Brook Drive
Glastonbury, CT 06033
860-368-5300

June 2008

Project # 073290*-1000


Frederick W. Johnson, LEP
Project Manager

LETTER OF TRANSMITTAL

455 Winding Brook Drive, Suite 201
Glastonbury, CT 06033
Phone: (860) 368-5300 Fax: (860) 368-5307
www.geiconsultants.com

To:	Carolyn Casey	Date:	June 19, 2008
	United States Department of Environmental Protection – Region 1	Project No.	073290-1000
	1 Congress Street, Suite 1100	Re:	Quality Assurance Project Plan (QAPP)
	Boston, MA 02144-2023		MacDermid Incorporated

We are sending you the following enclosures:

No.	Type	Description
1	Hard Copy	Quality Assurance Project Plan (QAPP)

These are transmitted as checked below:

☐ For Approval ☒ For Your Use ☐ For Review/Comment ☐ As Requested ☐ Other

Message:

Please see attached revised Quality Assurance Project Plan (QAPP). Please contact me with any questions.

Copy to: John Cordani – MacDermid Inc.
Dave Rinquist – CTDEP
Pete Long – The Environmental
Quality Company
Lorie MacKinnon
Rick Carr - TestAmerica

Signed:  for Fred Johnson

If enclosures are not as noted, kindly notify us at once.



Geotechnical
Environmental and
Water Resources
Engineering

Quality Assurance Project Plan (QAPP)

MacDermid Incorporated

526 Huntingdon Avenue, Waterbury Connecticut

USEPA ID# CTD001164599

Permit # DEP/HWM/CS-151-001

Submitted to:

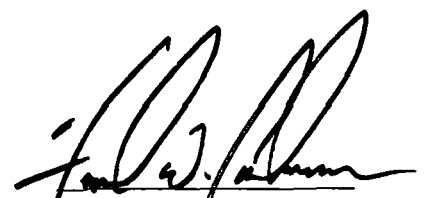
John Cordani
General Counsel/Corporate Secretary
MacDermid Incorporated
245 Freight Street
Waterbury, CT 06702

Submitted by:

GEI Consultants, Inc.
455 Winding Brook Drive
Glastonbury, CT 06033
860-368-5300

June 2008

Project # 073290*-1000



Frederick W. Johnson, LEP
Project Manager

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- A GEI Standard Operating Procedures (electronic only)
- B TestAmerica Standard Operating Procedures (electronic only)
- C TestAmerica Chain of Custody (electronic only)

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Abbreviations and Acronyms

AOC	Area of Concern
ASTM	American Society for Testing and Materials
BOD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CAMP	Community Air-Monitoring Plan
CERCLA	Comprehensive Environmental Response, Cleanup, and Liability Act
CFR	Code of Federal Regulations
COC	Chain of Custody
DL	Detection Limit
DNAPL	Dense Non-Aqueous Phase Liquid
DO	Dissolved Oxygen
DQO	Data Quality Objectives
EC	Engineering Controls
EIS	Environmental Impact Study
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
FS	Feasibility Study
FWRIA	Fish and Wildlife Resources Impact Analysis
GAC	Granular Activated Carbon
GC/MS	Gas Chromatograph/Mass Spectrometer
GFAA	Graphite Furnace Atomic Absorption Spectrometry
GIS	Geographic Information Systems
GPR	Ground-penetrating Radar
HASP	Health and Safety Plan
HOC	Halogenated Organic Compound
HDPE	High Density Polyethylene
HPLC	High Pressure Liquid Chromatography
HSO	Health and Safety Officer
IC	Institutional Controls
ICP	Inductively Coupled Plasma Atomic Emission Spectrometry
LEL	Lower Explosive Limit
LNAPL	Light Non-Aqueous Phase Liquid
MCL	Maximum Contaminant Level (for EPA Drinking Water Stnds)
MDL	Method Detection Limit
MGP	Manufactured Gas Plant
MSDS	Material Safety Data Sheet
NAPL	Non-aqueous Phase Liquids
NCP	National Contingency Plan
NPL	National Priority List
OSHA	Occupational Safety and Health Administration

PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
QA/QC	Quality Assurance / Quality Control
QAPP	Quality Assurance Project Plan
QHEA	Qualitative Human Exposure Assessment
RAO	Remedial Action Objectives
RAP	Remedial Action Plan
RCRA	Resource Conservation Recovery Act
RD	Remedial Design
RI	Remedial Investigation
RFP	Request For Proposal
RP	Responsible Party
SARA	Superfund Amendments and Reauthorization Act
SCGs	Standards, Criteria, and Guidance
SMP	Site Management Plan
SOP	Standard Operating Procedure
SOW	Scope of Work or Statement of Work
SPLP	Synthetic Precipitate Leaching Procedure
STEL	Short-Term Exposure Limit
SVE	Soil Vapor Extraction
SVOC	Semivolatile Organic Compounds
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compound from Mass Spectrometry
TOC	Total Organic Carbon
TOSCA	Toxic Substance Control Act
TPH	Total Petroleum Hydrocarbons
TWA	Time Weighted Average
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
USGS	United States Geologic Survey
VOC	Volatile Organic Compounds
WP	Work Plan
XREF	X-Ray Fluorescence

MEASUREMENTS

bgs	Below Ground Surface
msl	mean sea level
ppbv	Parts Per Billion by Volume
µg/L	Microgram per liter
µg/Kg	Microgram per kilogram
Mg/L	Milligram per Liter
Mg/Kg	Milligram per Kilogram
Mfl	Million fibers per liter

1. Form A – Title and Approval Page

1.1 Title

MacDermid Corporation, Stewardship Permit

Document Title

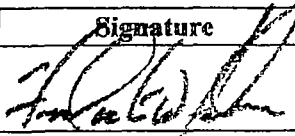
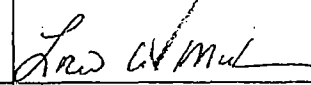
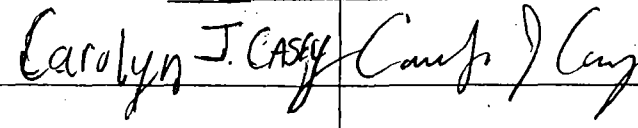
Brian C. Conte, GEI Consultants, Inc. Stewardship Permit

Prepared by: (Preparer's Name and Organizational Affiliation)

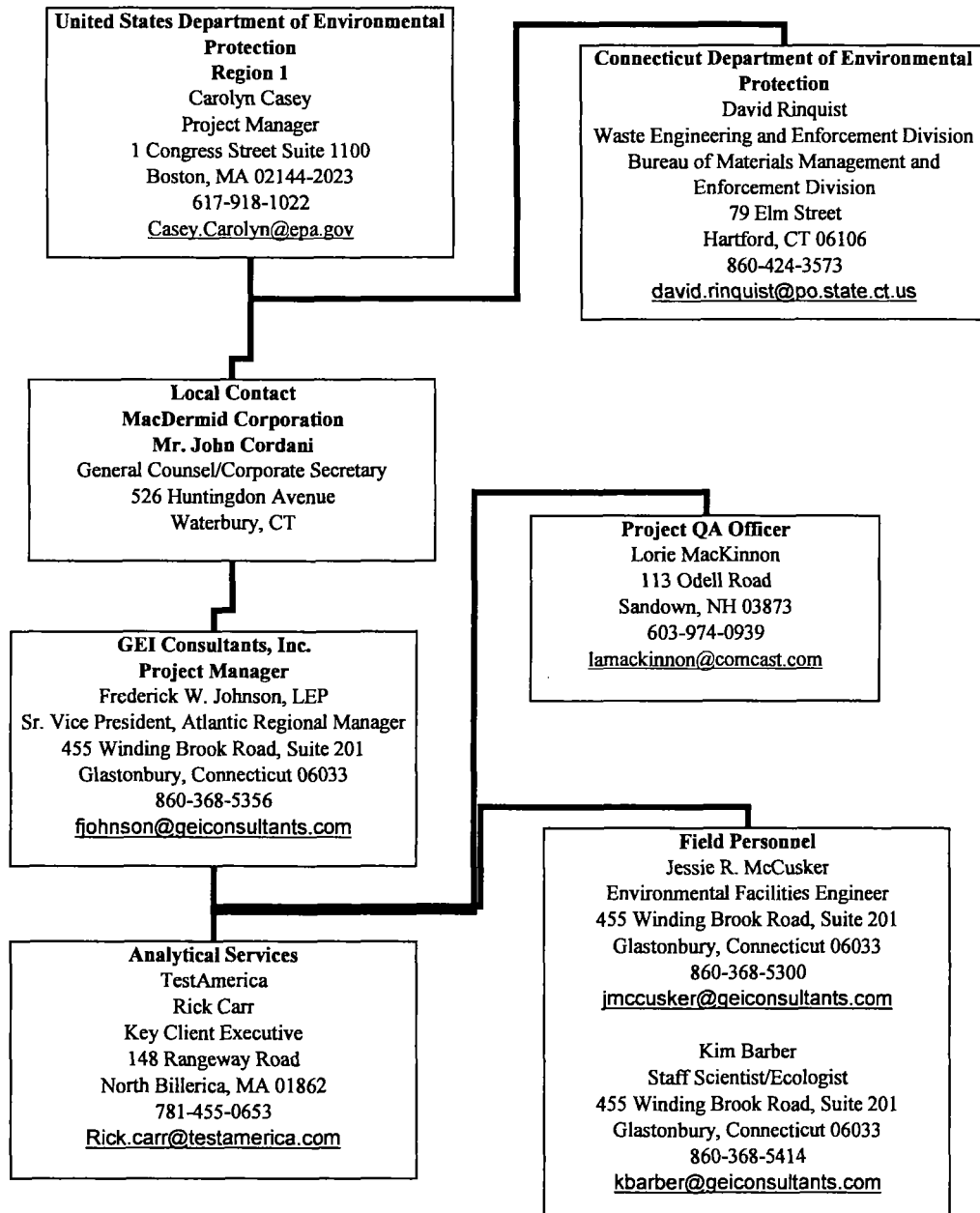
455 Winding Brook Drive, Suite 201, Glastonbury Connecticut

June 2008 Version 2

1.2 Approval Signatures

Title	Printed Name	Signature	Date
Project Manager	Frederick W. Johnson, LEP		6/12/08
Project QA Officer	Lorie MacKinnon		6/13/08
EPA Project Officer Approval	Carolyn J. Casey		7/15/08
EPA QA Officer Approval			

2. Form B – Project Organization and Responsibility



3. Form C – Problem Definition

3.1 Project Objective

The objective of this investigation is to satisfy the requirements for additional investigation as stated in the Connecticut Department of Environmental Protection (CTDEP) Stewardship Permit (Permit No. DEP/HWM/CS-151-001). The CTDEP in cooperation with the United States Environmental Protection Agency (EPA), issued MacDermid, Inc. (MacDermid) (EPA I.D. No. CTD001164599) a Stewardship Permit for the closure of its Huntingdon Avenue facility. The investigation detailed in this quality assurance project plan (QAPP) is an initial step in achieving compliance with the requirements stated within the Stewardship Permit.

The Stewardship Permit regulates and authorizes MacDermid to complete environmental investigation and cleanup ("closure" and "corrective action" measures) in accordance with Connecticut General Statutes (CGS) Sections 22a-6, 22a-449(c) and 22a-454, and Section 22a-449 of the Regulations of Connecticut State Agencies (RCSA). The site has historically been permitted under the Resource Conservation and Recovery Act (RCRA) for hazardous waste storage and recycling. Several solid waste management units (SWMUs) must be closed in accordance with the conditions of the Closure Plan dated December 5, 2002, entitled "Closure Plan Modification for MacDermid Incorporated Hazardous Waste Storage Areas" with revisions dated January 24, 2003 and March 7, 2003. Other SWMUs or areas of concern (AOC) as they are referenced in the permit must be similarly closed by implementation of corrective actions as necessary to meet cleanup criteria in the permit. Additional SWMUs and AOCs discovered during the course of groundwater monitoring, field investigations, environmental audits, or other means must be reported to the CTDEP as specified in the permit.

The final deliverable of the project will be a report documenting key finding of the investigation:

- Modifications to the site conceptual model (CSM) based on the new data.
- Recommendations for additional work and/or interim measures (IM), including an IM work plan.
- Details of any new release areas discovered beyond those identified in the Permit.
- Revisions to future schedule of activities.

3.2 Background and Current Understanding

The site is owned by MacDermid and is located at 526 Huntingdon Avenue in Waterbury, Connecticut (Figure 1). The site consists of two parcels designated in this report as the South and North parcel. The south parcel is located on the southern side of Huntingdon Avenue and encompasses approximately 11 acres. The south parcel is improved with three interconnected buildings having a total footprint of approximately 182,500 square feet. These buildings are referred to as the Gear Street Building, East Aurora Street Building, and the Huntingdon Avenue Building. There is little topographic relief on this parcel which lies approximately 300 feet above mean sea level. The site is located approximately 1,000 feet northwest of the Naugatuck River, which lies at approximately 260 feet above sea level. The site and immediate surroundings are zoned for industrial use.

The northern parcel is located on the northern side of Huntingdon Avenue, and encompasses approximately 30 acres. The investigation of the north parcel is limited to a paved area, located approximately 400 feet north of Huntingdon Avenue, which serves as an asphalt cap to a sludge and/or soil disposal area. The contents and characteristics of this material are to be determined during this investigation.

3.3 Historical Site Use

MacDermid. has been in operation at the site since 1930. From 1916 to 1928, the property was the location of the Waterbury Steel Ball Company (City of Waterbury, 1993). Before 1916, the property was owned by the Metal Specialty Company; it is not known what this company produced. The Waterbury Steel Ball Company leased the property to MacDermid until 1950, when MacDermid purchased the property (City of Waterbury Tax Records, 1993).

MacDermid was formerly in the business of blending or compounding of chemical materials used in the metal finishing, plating on plastics, and printed circuit industries and the recycling of spent chemicals from other MacDermid facilities and customers. MacDermid ceased operations at the site on December 31, 2003.

The facility was permitted August 8, 1994, as a commercial hazardous waste storage and recycling facility for RCRA and non-RCRA hazardous wastes. Pursuant to CGS Section 4-182 the former operating permit (DEP/HWM-151-208) was revoked upon issuance of the Stewardship Permit. This facility will remain a RCRA facility until it completes the closure and corrective action obligations in the Stewardship Permit.

3.4 Site Features

According to the Groundwater Quality Classification data layer in the most recent CTDEP Geographic Information System (GIS) database, groundwater beneath the South Parcel of the

Site and surrounding areas within 1.0 mile to the south, east and west continues to be designated as "GB". The southern portion of the MacDermid North parcel, which contains the paved sludge disposal area, is also classified as "GB" however the northern portion of the north parcel is classified as "GA". All areas that are the subject of this investigation are located in "GB" classified areas. According to the CTDEP Water Quality Standards (Ground Water Quality Standards Effective April 12, 1996), groundwater classified as GB is presumed not suitable for human consumption without treatment.

According to the August 7, 2007 Annual Groundwater Monitoring Report, prepared by Loureiro Engineering Associates, Inc (LEA), the predominant groundwater flow on the South Parcel is generally to the south, southeast, and east. Vertical gradients between the upper zone and deeper zone of the unconsolidated aquifer were assessed and indicated a downward hydraulic gradient in all four quarters of monitoring. Only two monitoring wells exist on the northern parcel preventing groundwater flow interpretation.

The site is located approximately 1,000 feet northwest of the Naugatuck River. The Naugatuck River is classified by the CTDEP as SB/SC indicating known impacts limiting the use of the river. Steele Brook is located approximately 3,000 feet to the south of the southern parcel and is classified as a SB stream also indicating degradation of water quality. No aquifer protection areas are located within five miles of the site.

Site geology has been evaluated during the course of investigation activities completed at the site by LEA and others. Geologic conditions encountered at the site are variable. The unconsolidated vadose zone sediments beneath the site range from grey brown and brown, fine to coarse sand with traces of gravel; a fill layer consisting of medium to coarse sand and building debris was identified in some boring locations to depths approximately five feet below grade; to heterogeneous glacial outwash material. These vadose zone deposits overlie a uniform deposit of fine to very fine sand and silt that was approximately encountered at a depth of approximately 17 to 60 feet below ground surface (bgs). The water table was encountered at depths of approximately 30 feet bgs within the very fine and silt stratum. Depth to bedrock has not been determined.

3.5 Conceptual Site Model

The current understanding of the CSM is provided in Table 1. The AOCs match those provided in Appendix A-1 of the Stewardship Permit. The conceptual site model is based on review of multiple previous investigations and reports:

- *Closure Plan Modification for MacDermid Hazardous Waste Storage Areas*, September 2002, LEA
- *December 1994 Steele Brook/Naugatuck River Sediment Sampling* December 1994, HRP
- *Well Receptor Survey*, February 2001, HRP

- *RCRA Corrective Action Stabilization Report*, March 2001, HRP
- *Closure Certification for Former Flammability Material Storage Area*, January 2002, HRP
- *Phase I ESA Report for Vacant Parcel Located at Huntingdon Avenue*, February 2002, LEA
- *MacDermid Inspection Report*, June 2002, LEA
- *Conceptual Site Model and Screening Levels*, May 2002
- *Closure Certification for Former NMP*, September 2002, HRP
- *Closure Certification for Former Spent Solder Stripper Recycling Area*, September 2002, HRP
- *Environmental Condition Assessment Form*, November 2002, LEA
- *MacDermid UST Removal Report 4,000-Gallons*, November 2002, LEA
- *Wastewater Treatment Closure Plan*, January 2003, LEA
- *Additional Investigations Work Plan and Quality Assurance Project Plan*, June 2004, LEA
- *Documentation of Environmental Indicator Determination*, February 2005, LEA
- *Annual Groundwater Monitoring Report*, August 2007, LEA
- *Stewardship Permit*, September 2007, CTDEP

3.6 Historic Data

The conceptual site model includes a description of AOCs, contaminant source, and release mechanisms. These descriptions are based on previous site activities and documented releases. A scope of work, provided by GEI and included with this QAPP, provides a detailed description of each AOC, previous data, and data gaps.

4. Form D – Project Description/Timeline

The Data Quality Objectives (DQO) for this scope of work is to further characterize and delineate documented AOCs. Characterization and delineation will be conducted on a per AOC basis with some sample points serving multiple purposes. Table 1 provides a summary of analytical samples to be collected per AOC. The Constituents of Concern (COCs) provided in the table are based on previous site activities.

Field observations are critical and will assist in the characterization of the AOC. However, comparison of laboratory results to Connecticut RSRs will ultimately determine further actions at each AOC. Standard Operating Procedures (SOPs) referenced in this section are provided in Appendix A of this document.

4.1 Field Screening and Observations

The investigation will be performed on three types of media: soil, concrete and groundwater. Field screening and observations will include, but are not limited to concrete chip samples, installation of borings, groundwater monitoring wells, monitoring well development, and groundwater sampling. Detailed observations will be documented in the field notebooks (FD-001), photodocumentation (FD-004), boring and monitoring well logs, SOPs SM-003 and DM-007, respectively.

Photo-ionization detector (PID) will be used as a field-screening technique. All soil borings and soil cuttings derived during field activities will be screened in accordance with SOP SC-004. The highest meter response generated during the head-space screening will be recorded. Potential interferences, such as moisture content, will be noted.

All soil classifications will be performed in accordance with SOP SM-003. The Unified Soil Classification (UCS) standards for soil description will be employed. Additional characteristics such as odor, interval, and PID recordings will be noted.

A description of the quality of groundwater, during development and sampling, will be recorded in field notebooks. A description of contaminants (e.g. sheen), odor, and non-aqueous phase liquids (NAPL) will be provided.

4.2 Soil Sampling

Soil samples will be collected during installation of borings using direct-push and split-spoon methodology. SOPs for split-spoon sampling (SM-001 Section 2.4) will be followed. The depth of the soil boring is dependent on the AOC and field observations. With the exception

of the borings installed for monitoring wells, it is unlikely the borings will extend past 15 feet below ground surface.

Soils exhibiting the highest contaminant impact (e.g. PID readings) will be selected for analysis. If none of the intervals appear impacted, sample depth will be based on the potential release area:

1. Below the root zone will be analyzed in areas where surficial releases are suspected.
2. Just above the water table in areas where a subsurface release is suspected.

Soil samples will be compared to Connecticut RSR standards for residential direct exposure (RES DEC), industrial/commercial direct exposure (I/C DEC), and GB pollutant mobility criteria (GB PMC). In addition, volatile organic compounds will be compared to both the proposed residential and industrial/commercial soil vapor volatilization criteria (SVVC). Form L provides the appropriate comparisons. Table 1 provides a summary of analytical samples and analysis to be collected from the soil.

4.3 Concrete Chip Sampling

Surficial floor concrete chip sampling may be performed in AOCs D2 (Main Mixing Area) and K8 (Chemical Storage Area). The concrete samples are to assess if contaminants have migrated through the porous surfaces of the concrete. Concrete sampling will be performed in accordance with SOP SM-007. It is important to note that the samples will be collected as a chip sample using methods (e.g. chisel) to reduce the generation of heat or release of VOCs. Table 1 provides a summary of analytical samples and tests to be collected from the concrete.

4.4 Groundwater Sampling

Groundwater samples will be collected from existing and new monitoring wells. Groundwater samples will not be collected within two weeks of development in accordance with SOP DM-009 Monitoring Well Development. Monitoring well borings will extend to the shallow overburden groundwater estimated at 35 feet below ground surface. Monitoring well installation will be in accordance with DM-0007. Field personnel will be vigilant to avoid puncturing any confining layers (i.e. silt or clay). Hydrated bentonite or grout will be used to backfill any such confining layer that is encountered.

With the exception of MW-131, all of the newly installed monitoring wells will be fitted with 10-foot screens with eight feet of the interval in the groundwater leaving two feet above the water table to allow for fluctuation. MW-131 is designed to investigate the presence of dense non-aqueous phase liquid (DNAPL) at the overburden/bedrock interface. Therefore, the

monitoring well will be extended to the top of bedrock, which is estimated at 60 feet below ground surface. PVC pipe fitted with a ten-foot screen will extend to the top of bedrock.

All analytical results will be compared to surface water protection criteria (SWPC) and proposed residential and industrial/commercial groundwater volatilization criteria (GWVC). Table 1 provides a summary of analytical samples and analysis to be collected from the groundwater.

4.5 Timeline of Events

Activities	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
QAPP Review	X	X	X	X												
QAPP Finalized					X	X										
Site Markout with Call Before You Dig						X										
Boring and Monitoring Well Installation and Soil Sampling*							X									
Monitoring Well Development							X									
Groundwater Sampling										X						
Laboratory Analysis												X	X			
Data Validation													X	X		
Report comparing analytical data to RSR standards														X	X	X

* Field activities are contingent on weather conditions and coordination with client.

5. Form E – Sampling Design and Site Figures

5.1 Sampling Design

The sampling program outlined in this QAPP is designed to investigate individual on-site AOCs. The rationale used in investigating each AOC is provided in Table 1. The locations of the sample points are provided in Figure 2. The majority of sampling points are designed to assess if a release has occurred. Therefore, sample intervals and locations will be chosen to bias the likelihood of detecting a release. If a release is evident during sample collection, a dynamic sampling strategy will be employed to further define the extent of the contamination. This method will ultimately reduce investigational time and costs.

A release shall be determined based on field observations, comparison to background concentrations (if applicable), and comparison to applicable RSR criteria. Data collected during this investigation will be used to further redefine the existing conceptual site model. Recommendations for additional investigation will be provided on a per AOC basis and based on historic data, sample coverage, and future redevelopment use.

5.2 Communications between GEI and Laboratory

GEI has conducted pre-project planning activities with TestAmerica including providing the Project Communication Form as provided in the CTDEP Laboratory Quality Assurance and Quality Control Guidance Reasonable Confidence Protocols. TestAmerica is aware of the goals of the investigation, sample density, and reporting requirements. The pre-planning activities have highlighted several important issues.

- Mr. Rick Carr of TestAmerica will be assigned project representative for the entire project.
- A sample TestAmerica Chain of Custody (COC) is provided in Appendix C.
- TestAmerica is familiar with, and will adhere to, laboratory quality control procedures set forth in the CTDEP *Laboratory Quality Assurance and Quality Control Guidance Reasonable Confidence Protocols*.
- TestAmerica will provide a turnaround time of results to be reported within 10 working days.
- In order to meet RSR criteria for arsenic, TestAmerica will perform ICP/MS to reduce reporting limits to below SWPC. Arsenic reporting limits are provided and compared to RSR criteria in Table 3.
- In order to meet RSR criteria for certain PAHS, TestAmerica will perform Method 8270 with Selective Ion Monitoring (SIM) to reduce reporting limits to below the

SWPC. The SIM reporting limits are provided and compared to RSR criteria in Table 3.

- TestAmerica is aware that high concentrations of total metal concentrations, PAHs, or ETPH will result in performance of SPLP analysis. TestAmerica is prepared to report these concentrations in enough time to meet the respective holding times for extraction.

6. Form F – Sampling and Analytical Methods Requirements

Parameter	Matrix	Number of Samples	Analytical Method	Containers (Number, size and type)	Preservation Requirements (temperature, light, chemical)	Maximum Holding Time (preparation/analysis)
RSR-14 Metals	Solid (soil/concrete)	55 + 2 E.B. + 2 Duplicates	EPA Method 6010	1 eight ounce non-preserve amber bottle with Teflon-lined cap.	Cool to $4 \pm 2^{\circ}\text{C}$	180 days to extract/180 days for analysis
Mercury	Solid (soil/concrete)	55 + 2 E.B. + 2 Duplicates	EPA Method 7471A	1 eight ounce non-preserve amber bottle with Teflon-lined cap.	Cool to $4 \pm 2^{\circ}\text{C}$	28 days for analysis
Tin	Solid (soil/concrete)	55 + 2 E.B. + 2 Duplicates	EPA Method 6010	1 eight ounce non-preserve amber bottle with Teflon-lined cap.	Cool to $4 \pm 2^{\circ}\text{C}$	180 days to extract/180 days for analysis
TCLP Metals	Solid (soil/concrete)	Based on Total Concentrations	EPA Method 1311	1 eight ounce non-preserve amber bottle with Teflon-lined cap.	Cool to $4 \pm 2^{\circ}\text{C}$	180 days from collection until leaching, except for mercury, where leaching must start within 28 days.
SPLP Metals	Solid (soil/concrete)	Based on Total Concentrations	EPA Method 1312	1 eight ounce non-preserve amber bottle with Teflon-lined cap.	Cool to $4 \pm 2^{\circ}\text{C}$	180 days from collection until leaching, except for mercury, where leaching must start within 28 days.
Total Cyanide	Solid (soil/concrete)	53 + 2 E.B. + 2 Duplicates	EPA Method 9012	250 mL glass jar with Teflon-lined cap.	Cool to $4 \pm 2^{\circ}\text{C}$	14 days or analysis

Parameter	Matrix	Number of Samples	Analytical Method	Containers (Number, size and type)	Preservation Requirements (temperature, light, chemical)	Maximum Holding Time (preparation/analysis)
Volatile Organic Compounds	Solid (soil/concrete)	58 + 2 E.B.+ 2 Duplicates + 2 F.B.	EPA Method 8260B	Samples should be collected and stored according to CTDEP Guidance for <i>Collecting and preserving Soil and Sediment Samples for Laboratory Determination of Volatile Organic Compounds</i> , ver.2.0 Feb. 28, 2006. One separate 4 oz. container should be collected for % solids determination.	Ice samples in field and proceed with preservation option selected. Preservation options include methanol, sodium bisulfate, and freezing. (See notes 2 & 3).	14 days if preserved. 48 hours if unpreserved. (Note 4).
Extractable Petroleum Hydrocarbons	Solid (soil/concrete)	55 + 2 E.B.+ 2 Duplicates	CTETPH	250-mL amber glass jar with Teflon-line cap	Cool to 4 ± 2° C	14 days for analysis
PCBs	Solid (soil/concrete)	2 +1 E.B. + 1 Duplicate				

Notes:

- No field-generated matrix spikes (MS) or matrix-spike duplicates (MSD) are currently planned. All MS and MSD will be generated by the laboratory for laboratory precision.
- Note 1: The number of sample containers is optional. Laboratories should supply enough containers to allow for any reanalysis or breakage.
- Note 2: EnCore Samplers may not be suitable for all soil types. See Method 5035A in SW-846 and the DEP Guidance For Collecting And Preserving Soil and Sediment Samples for Laboratory Determination of Volatile Organic Compounds, ver. 2.0 Feb. 28, 2006 for guidance.
- Note 3: If samples effervesce upon addition of sodium bisulfate, than bisulfate cannot be used as a preservative. Another preservation option must be selected.
- Note 4: If the freezing option is selected, the sample must be frozen within 48 hours of collection. The holding time recommences when thawing begins. The total holding time is calculated from the time of collection to freezing plus the time allowed for thawing. The total elapsed time must be less than 48 hours.
- Field blanks (FB) and trip blanks (TB) will be a water matrix and consist of laboratory grade deionized water preserved in 40-ml vials preserved with hydrochloric acid.
- Equipment blanks (EB) consist of capturing the rinseate after non-dedicated equipment (e.g. hand auger) has been decontaminated. Aqueous matrix will require preservation specific to each method.
- All analysis will be done in accordance with CTDEP Reasonable Confidence Protocols.

Parameter	Matrix	Number of Samples	Analytical Method	Containers (Number, size and type)	Preservation Requirements (temperature, light, chemical)	Maximum Holding Time (preparation/analysis)
Total Analyte List Metals	Groundwater	31 + 2 E.B. + 2 Duplicates	EPA Method 6010	1-Liter Plastic or Glass	Cool to $4 \pm 2^\circ \text{C}$. Nitric Acid to $<2 \text{ pH}$	180 days to extract/180 days for analysis
Mercury	Groundwater	31 + 2 E.B. + 2 Duplicates	EPA Method 7471A	1-Liter Plastic or Glass	Cool to $4 \pm 2^\circ \text{C}$. Nitric Acid to $<2 \text{ pH}$	28 days for analysis
Total Cyanide	Groundwater	32 + 2 E.B. + 2 Duplicates	EPA Method 9012	250-mL glass jar with Teflon-lined cap.	Cool to $4 \pm 2^\circ \text{C}$	14 days for analysis
Volatile Organic Compounds	Groundwater	33 + 2 E.B. + 2 Duplicates + 2 F.B.	EPA Method 8260B	Two 40-mL vial with Teflon-lined cap	Cool to $4 \pm 2^\circ \text{C}$. Hydrochloric Acid to $<2 \text{ pH}$	14 days for analysis
Semi-Volatile Organic Compounds	Groundwater	23 + 1 E.B. + 1 Duplicates	EPA Method 8270D	1-Liter amber glass bottle with Teflon-lined cap	Cool to $4 \pm 2^\circ \text{C}$	7 Days to extraction, 40 days from extraction to analysis.
Extractable Petroleum Hydrocarbons	Groundwater	10 + 1 E.B. + 1 Duplicates	CTETPH	One-Liter amber glass bottle with Teflon-lined cap	Cool to $4 \pm 2^\circ \text{C}$	14 days for analysis

Notes:

1. Field blanks (FB) and trip blanks (TB) will be a water matrix and consist of laboratory grade deionized water preserved in 40-ml vials preserved with hydrochloric acid.
2. Equipment blanks (EB) consist of capturing the rinseate after non-dedicated equipment (e.g. hand auger) has been decontaminated. Aqueous matrix will require preservation specific to each method.
3. All analysis will be done in accordance with CTDEP Reasonable Confidence Protocols.

7. Method and SOP Reference Table

Analytical Method Reference ¹	Project Analytical SOPs ²
1a. METHOD 6010B Metals Analysis by Inductively Coupled Plasma Spectroscopy EPA Method 6010B, SW-846 EPA Draft Revision 1, April 2001	Title: SOP for ICP Metals Analysis (Method SW846 6010B) SOP No. CT-MES-20, Rev. 6 Effective Date: 10/20/07
2a. METHOD 7471A Mercury in Liquid Waste (Manual Cold-Vapor Technique) EPA revision 1, September 1994	Title: SOP for Mercury – Solids, Hot Block Digestion (Method SW846 7471A) SOP No. CT-MES-32, Rev. 5 Effective Date: 10/30/07
3a. METHOD 1311 Toxicity Characteristic Leaching Procedure EPA revision 0, July 1992	Title: SOP for TCLP Preparation (Method SW846 1311) SOP No. CT-CVS-15, Rev. 4 Effective Date: 08/30/07
4a. METHOD 9012 Total and Amenable Cyanide (Automated Colorimetric with off-line Distillation) EPA revision 1, December 1996	Title: SOP for Total Cyanide (Method SW846 9012B) SOP No. CT-CVS-54, Rev. 5 Effective Date: 01/30/08
5a. Method 8260B Volatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (GC/MS) EPA Revision 2, 1996	Title: SOP for GC/MS Volatiles (Method SW846 8260B) SOP No. CT-MSS-28, Rev. 8 Effective Date: 08/31/07
6a. Method 8270D Semi volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) EPA Revision 4, January 1998	Title: SOP for GC/MS Semivolatiles (Method SW846 8270C) SOP No. CT-MSS-27, Rev. 10 Effective Date: 01/30/08
7a. Connecticut Method for Extractable Total Petroleum Hydrocarbons Connecticut Department of Environmental Protection Version 1.0, July 2005	Title: SOP for State of Connecticut ETPH Method (Method CTETPH) SOP No. CT-GCS-27, Rev. 4 Effective Date: 01/30/08

GEI Project Sampling SOPs³

HS-001 General Guidance on Health and Safety (Rev. 1, June 2008)

PM-001 Public Utility Markout (Rev. 1, June 2008)

RE-001 Site Reconnaissance (Rev. 1, June 2008)

FD-001 Field Notebook (Rev. 1, June 2008)

FD-003 Sample Handling and Chain of Custody (Rev. 1, June 2008)

FD-004 Photodocumentation (Rev. 1, June 2008)

DM-002 Hollow Stem Auger (Rev. 1, June 2008)

DM-004 Sonic Drilling (Rev. 1, June 2008)

DM-006 GeoProbe [™] Direct Push Boring (Rev. 1, June 2008)

DM-007 Monitoring Well Construction and Installation (Rev. 1, June 2008)

DM-008 Monitoring Well Telescoping (Rev. 1, June 2008)

DM-009 Monitoring Well Development (Rev. 1, June 2008)

SC-001 Sample Collection (Rev. 1, June 2008)

SC-002 Sample Handling (Rev. 1, June 2008)

SC-003 Investigation Derived Wastes (Rev. 1, June 2008)

SC-004 Head Space Screening (Rev. 1, June 2008)

SM-001 Soil Sampling (Rev. 1, June 2008)

SM-002 VOC Soil Collection and Preservation Method (Rev. 1, June 2008)

SM-003 Soil Classification (Rev. 1, June 2008)

SM-007 Chip Sampling (Rev. 1, June 2008)

GW-001 Water Level Measurement (Rev. 1, June 2008)

GW-002 Light Non-Aqueous Phase Liquid Measurement (Rev. 1, June 2008)

GW-003 Low Flow (low stress) Groundwater Sampling (Rev. 1, June 2008)

GW-004 pH and Temperature Measurement (Rev. 1, June 2008)

GW-005 Turbidity Measurement (Rev. 1, June 2008)

GW-006 Specific Conductance Measurement (Rev. 1, June 2008)

GW-007 Dissolved Oxygen Measurement (Rev. 1, June 2008)

QA-001 Equipment Decontamination (Rev. 1, June 2008)

QA-002 Field and Laboratory Quality Control Procedures (Rev. 1, June 2008)

Notes:

- 1 - References for EPA and CTDEP Analytical Methods are not provided in QAPP but are readily available on-line.
- 2 - All Laboratory SOPs and testing methods employed during this investigation are provided in Appendix B of this document.
- 3 - All GEI project sampling SOPs are provided in Appendix A of this QAPP.

8. Form H – Field Equipment Calibration and Corrective Action

Instruments and equipment used to collect, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accurately and reproducibility of results are consistent with the manufacture's specifications. The calibration and internal standards shall meet all criteria specified in the referenced analytical method.

For all analysis for which EPA or CTDEP-approved methods exist, the laboratory will employ such methods and follow the calibration process and frequencies specified.

Calibration of field instruments and equipment will be performed as specified by the manufacturer or more frequently as conditions dictate. The minimum calibration of field instrumentation is once at the beginning of the sampling event, and as necessary. Calibration standards used as reference will be traceable to the National Institute of Standards and Technology (NIST), when existent.

Records of calibration, repair, or replacement will be filed and maintained by the designated laboratory personnel performing quality control activities. Calibration records of assigned laboratories will be filed and maintained at the laboratory location where the work is performed and subject to QA audit.

Instrument	Activity	Frequency	Acceptance Criteria	SOP Ref.
Photoionization Detector	<ul style="list-style-type: none"> - Check Battery - Check Filter - Calibrate using Isobutylene Standard - Clean ultraviolet (UV) lamp 	Daily prior to use	+/- 1.0 ppm	Refer to Manufacturers Requirements, SOP TE-001
Water Level Meter	Clean meter and visually inspect for defective parts.	Daily prior to use	+/- 0.1 foot	Refer to Manufacturers Requirements, Groundwater Sampling SOP SA-002
Turbidimeter	Visually inspect for defective parts. Check calibration using standard	Daily prior to use	+/- 5 %	Refer to Manufacturers Requirements, Groundwater Sampling SOP SA-002
pH Probe	Clean/visually inspect probe.	Daily prior to use	pH – stable readings +/- 0.1 pH units within 3	Refer to Manufacturers Requirements, Groundwater Sampling SOP SA-002
Dissolved Oxygen Probe	Clean/visually inspect probe, change KCl, and change Teflon® membrane	Prior to initial use, and if bubbles appear below membrane, if unstable readings given, or if dried electrolyte visible on	D.O. +/- 0.2 mg/L	Refer to Manufacturers Requirements, Groundwater Sampling SOP SA-002
Specific Conductance Electrode	Clear opening to probe. Check accuracy using standard solutions.	Prior to initial use	Conductivity - +/- 1 ohm/cm of standard	Refer to Manufacturers Requirements, Groundwater Sampling SOP TE-005
Oxidation-Reduction Potential Meter	Check accuracy using standard solutions. Visually inspect probe	Daily before use	ORP +/- 1mV of standard	Refer to Manufacturers Requirements, Groundwater Sampling SOP SA-002
Temperature Sensor	Check accuracy using standard solutions. Visually inspect probe	Daily before use	Temperature +/- 15%	Refer to Manufacturers Requirements, Groundwater Sampling SOP SA-002

9. Form I – Laboratory Equipment Calibration and Corrective Action

Method 8260B Volatile Organic Compounds

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
GC/MS Tunes with BFB	Inter-laboratory consistency and comparability	1) Criteria listed in Table 4 of SW-846 Method 8260 (the same criteria must be used for all analyses) 2) Every 12 hours	NO	Perform instrument maintenance as necessary; retune instrument	Suspend all analyses until tuning non-compliance is rectified.
Initial Calibration (ICAL)	Laboratory Analytical Accuracy	1) Minimum of 5 standards. (Note 1). Single point calibration allowed for surrogates. 2) Low standard must be \leq reporting limit (RL) 3) % RSD ≤ 15 or " r " ≥ 0.990 for all compounds except CCC's, which must be $\leq 30\%$ RSD or " r " ≥ 0.990 4) Must contain all target analytes 5) If regression is used, must not be forced through the origin. 6) Minimum RF for all compounds 0.05.	NO	Recalibrate as required by method (1) if any of CCC %RSDs or if any one of CCC " r " < 0.990 or (2) if $> 20\%$ of remaining analytes have %RSD > 30 or " r " < 0.990 .	Sample analysis cannot proceed without a valid initial calibration. Report non-conforming compounds in case narrative. If the average response factor or linear regression are not used for quantitation (e.g. use of a quadratic equation), this must be noted in narrative with a list of affected analytes.
ICAL Verification Standard	Laboratory Analytical Accuracy	1) Each ICAL must be verified against a second source standard. 2) Std should be at mid-point 3) All target analytes present	NO	1) Compounds must recover within 80-120% 2) Laboratories are allowed to have 20% of compounds out, as long as all compounds within recover 65-135%	1) Perform maintenance as needed, recalibrate. 2) Note outliers in narrative.

Method 8260B Volatile Organic Compounds (cont.)

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Continuing Calibration Std (CCAL)	Laboratory Analytical Accuracy	1) Every 12 hrs prior to analysis of samples 2) Concentration level near midpoint of curve 3) Must contain all target analytes 4) Percent difference or percent drift (%D) must be ≤ 20 for CCCs and should be ≤ 30 for all other compounds.	NO	Recalibrate as required by method: (1) if %D of any CCC > 20 or (2) If %D of $> 10\%$ of other analytes > 30 .	Report non-conforming compounds in case narrative.

Notes:

State of Connecticut Department of Environmental Protection Recommended Reasonable Confidence Protocols Quality Assurance and Quality Control Requirements Volatile Organics by Method 8260, SW-846 Version 3.0 July 2006

* Refers to latest published version of SW-846 Method 8260. r = Correlation Coefficient

GC/MS = Gas Chromatography/Mass Spectrometry RPD = Relative Percent Difference

BFB = 4-Bromofluorobenzene CCC = Calibration Check Compound

%RSD = Relative Percent Standard Deviation N/A = Not Applicable

RF = Relative Response Factor

EP = Environmental Professional

Potentially Difficult Compounds include acetone, bromomethane, chloroethane, dichlorodifluoromethane, dibromochloromethane, hexachlorobutadiene, 2-butanone (MEK), 4-methyl-2-pentanone, and trichlorofluoromethane.

Note 1: Six standards are required for a quadratic equation calibration curve, and seven are required for a polynomial fit. In either case the correlation coefficient must be ≥ 0.990 . Surrogates may be calibrated using a single point, at the same concentration as added to all samples, blanks, etc.

Method 8270 Semi-Volatile Organic Compounds

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
GC/MS Tunes with DFTPP	Inter-laboratory consistency and comparability	1) Criteria listed in Table 1C of this document. (the same criteria must be used for all analyses) 2) Every 12 hours 3) Pentachlorophenol and benzidine peak tailing should be evaluated. Peak tailing factor must be <3 for benzidine and <5 for pentachlorophenol. Note: Tune must be performed in full SCAN mode for SIM Analysis.	NO	Perform instrument maintenance as necessary; retune instrument.	Suspend all analyses until tuning non-compliance is rectified. Report peak tailing exceedences in narrative.
Initial Calibration (ICAL)	Laboratory Analytical Accuracy	1) Minimum of 5 standards. (Note 1) 2) Low standard must be \leq reporting limit (RL) 3) Full Scan % RSD ≤ 15 or " r " ≥ 0.990 for all compounds except CCC's, which must be $\leq 30\%$ RSD or " r " ≥ 0.990 . SIM % RSD ≤ 30 or " r " ≥ 0.990 . 4) Must contain all target analytes 5) If regression is used, must not be forced through the origin. 6) If SIM is used, laboratory must monitor at least two ions/analyte for all targets, surrogates, and IS's. 7) Minimum RF for all compounds > 0.05 .	NO	Recalibrate as required by method (1) if any of CCC %RSDs or if any one of CCC " r " < 0.990 or (2) if $> 20\%$ of remaining analytes have %RSD > 30 or " r " < 0.990 .	Sample analysis cannot proceed without a valid initial calibration. Report non-conforming compounds in case narrative. If the average response factor or linear regression are not used for quantitation (e.g. use of a quadratic equation), this must be noted in narrative with a list of affected analytes.
ICAL Verification Standard	Laboratory Analytical Accuracy	1) Each ICAL must be verified against a second source standard. 2) Std should be at mid-point 3) All target analytes present	NO	1) Compounds must recover within 80-120% 2) Laboratories are allowed to have 20% of compounds out, as long as all compounds within recover 65-135%.	1) Perform maintenance as needed, recalibrate. 2) Note outliers in narrative.

Method 8270 Semi-Volatile Organic Compounds (cont.)

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Continuing Calibration Std (CCAL)	Laboratory Analytical Accuracy	1) Every 12 hrs prior to analysis of samples 2) Concentration level near midpoint of curve 3) Must contain all target analytes 4) Full Scan: Percent difference or percent drift (%D) must be ≤ 20 for CCCs and should be ≤ 30 for all other compounds. SIM: Percent difference or percent drift (%D) must be should be ≤ 30 for all compounds	NO	Recalibrate as required by method (1) if %D of any CCC > 20 or (2) if %D of $> 10\%$ of other analytes > 30 .	Report non-conforming compounds in case narrative.

Notes:

Source: State of Connecticut Department of Environmental Protection Recommended Reasonable Confidence Protocols Quality Assurance and Quality Control Requirements Semivolatile Organics by Method 8270, SW-846 Version 2.0

July 2006

* Refers to latest published version of SW-846 Method 8270. r = Correlation Coefficient

GC/MS = Gas Chromatography/Mass Spectrometry RPD = Relative Percent Difference

DFTPP = Decafluorotriphenylphosphine CCC = Calibration Check Compound

%RSD = Relative Percent Standard Deviation N/A = Not Applicable

EP = Environmental Professional

Note 1: Six standards are required for a quadratic equation calibration curve, and seven are required for a polynomial fit. In either case the correlation coefficient must be ≥ 0.990 . Potentially Difficult Compounds include dimethyl phthalate, 4-nitrophenol, phenol, 4-methylphenol, 2-methylphenol, 2,4-dinitrophenol, pentachlorophenol, and 4-chloroaniline.

Method 6010 Trace Metals

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Initial Calibration	Laboratory Analytical Accuracy	1) Daily following instrument profiling and prior to sample analysis. 2) Minimum of calibration blank plus one standard. 3) Linear curve with "r" \geq 0.995. Can use second order fit if $r \geq$ 0.995.	NO	Re-optimize instrument and recalibrate as necessary.	Linear curve criteria applicable to calibration curves with blank plus 2 or more calibration standards.
Initial Calibration Verification (ICV)	Laboratory Analytical Accuracy	1) Daily immediately after calibration and prior to sample analysis. 2) 2 nd source std 3) ICV \pm 10% of true value. Must use at least two replicates with RPD $<$ 5%	NO	Re-calibrate/Re-analyze ICV as required by method.	Suspend all analyses until problem corrected and ICV meets criteria.
Initial Calibration Blank (ICB)	Evaluation of instrument drift, sensitivity, and contamination.	1) Daily immediately after ICV. 2) Matrix matched with standards and samples. 3) ICB must be $<$ RL	NO	Re-calibrate/Re-analyze ICB as required by method.	
Low Level Calibration Check Standard	Instrument sensitivity to support RL	Only required if low calibration standard not at or below RL 1) Daily prior to sample analysis 2) Std concentration \leq RL for all analytes 3) Recovery \pm 30% of true value except for antimony, arsenic, cobalt, and thallium which have a \pm 50% limit.	NO	Recalibrate/ Narrate	Report non-conformances in narrative.
Continuing Calibration Verification (CCV)	Laboratory Analytical Accuracy	1) Every 10 samples and at end of analytical sequence. 2) Can be same source or second source. 3) Recovery \pm 10% of true value, Must use at least two replicates with RPD $<$ 5%.	NO	Recalibrate/Re-analyze all samples since last compliant CCV.	Report non-conformances in narrative.
Continuing Calibration Blank (CCB)	Evaluation of instrument drift, sensitivity, and contamination.	1) Every 10 samples immediately after CCV. 2)) Matrix matched with standards and samples. 3) ICB must be $<$ RL	NO	Recalibrate/Re-analyze all samples since last compliant CCV.	Report non-conformances in narrative.

Method 6010 Trace Metals (cont.)

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Interference Check Standards (ICSA & ICSAB)	Laboratory Analytical Accuracy	1) Daily prior to sample analysis and at the end of the analytical sequence. 2) ICSA and ICSAB containing known amounts of analytes and/or interferences per method. 3) Recoveries for all analytes $\pm 20\%$ of true value or 2x the RL, whichever is greater. If analyte not present, its true value is zero.	NO	May require adjustment of interelement, correction factors, background correction and/or linear ranges	Report non-conformances in narrative.

Notes:

State of Connecticut Department of Environmental Protection Recommended Reasonable Confidence Protocols
Quality Assurance and Quality Control Requirements Determination of Trace Metals By SW-846
Method 6010 Inductively Coupled Plasma-Atomic Emission Spectrometry Version # 2.0 July 2006

* Refers to latest promulgated version of SW-846 Method 6010.

r = Correlation Coefficient

RPD = Relative Percent Difference

%RSD = Relative Percent Standard Deviation

N/A = Not Applicable

Method 7470 Mercury

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Preparation of Samples	Accuracy and Representativeness	All samples must be digested prior to analysis. See Methods 7470 and 7471 for details. Note only one preparation required for each field sample.	NO	See Section 1.2.3 for guidance on obtaining representative soil results.	See Section 1.2.3 for guidance on obtaining representative soil results.
Initial Calibration	Laboratory Analytical Accuracy	1) Daily prior to sample analysis. 2) Minimum of calibration blank plus five calibration standards. 3) Linear curve with "r" \geq 0.995. Can use second order fit if "r" \geq 0.995.	NO	Re-optimize instrument and recalibrate as necessary.	Sample analysis cannot proceed without valid initial calibration.
Initial Calibration Verification (ICV)	Laboratory Analytical Accuracy	1) Daily immediately after calibration and prior to sample analysis. 2) 2 nd source std 3) ICV \pm 10% of true value.	NO	Re-calibrate/Re-analyze ICV as required by method.	Suspend all analyses until problem corrected and ICV meets criteria.
Initial Calibration Blank (ICB)	Evaluation of instrument drift, sensitivity, and contamination.	1) Daily immediately after ICV. 2) Matrix matched with standards and samples. 3) ICB must be < RL	NO	Re-calibrate/Re-analyze ICB as required by method.	
Low Level Calibration Check Standard	Instrument sensitivity to support RL	Only required if low calibration standard not at or below RL 1) Daily prior to sample analysis 2) Std concentration at RL for all analytes 3) Recovery \pm 30% of true value.	NO	Recalibrate/Narrate	Report non-conformances in narrative
Continuing Calibration Verification (CCV)	Laboratory Analytical Accuracy	1) Every 10 samples and at end of analytical sequence. 2) Can be same source or second source. 3) Recovery \pm 20% of true value	NO	Recalibrate/Re-analyze all samples since last compliant CCV	Report non-conformances in narrative.
Continuing Calibration Blank (CCB)	Evaluation of instrument drift, sensitivity, and contamination.	1) Every 10 samples immediately after CCV. 2)) Matrix matched with standards and samples. 3) CCB must be < RL	NO	Recalibrate/Re-analyze all samples since last compliant CCV.	Report non-conformances in narrative.

Note:

State of Connecticut Department of Environmental Protection Recommended Reasonable Confidence Protocols
Quality Assurance and Quality Control Requirements Determination of Mercury By SW-846 Methods 7470/7471
Cold Vapor Atomic Absorption Spectroscopy Version # 2.0 July 2006

Method 9010 Cyanide

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Preparation of Samples	Accuracy and Representativeness	All samples must be distilled prior to analysis. See Methods 9010 for details.	NO		
Initial Calibration	Laboratory Analytical Accuracy	1) For manual colorimetric procedure at least every six months or whenever ICV fails. For semi-automated procedure, daily prior to sample analysis. 2) Minimum of calibration blank plus five calibration standards. Low standard must be \leq RL. 3) Linear curve with " r " \geq 0.995. 4) Samples and stds matrix matched. 5) If titration used, silver nitrate must be standardized as in Method SM4500-CN D (Note 1) every 30 days. 6) Stock cyanide solution must be checked monthly.	NO	Re-optimize instrument and recalibrate as necessary.	Sample analysis cannot proceed without valid initial calibration.
Initial Calibration Verification (ICV)	Laboratory Analytical Accuracy	1) For manual colorimetric and titration procedure, daily and prior to sample analysis. For semi-automated procedure daily immediately after calibration. 2) 2 nd source std distilled with batch mid-range or vendor supplied value. 3) ICV \pm 15% of true value.	NO	Re-calibrate/Re-analyze ICV as required by method.	Suspend all analyses until problem corrected and ICV meets criteria.
Continuing Calibration Verification (CCV)	Laboratory Analytical Accuracy	1) Every 10 samples and at end of analytical sequence. 2) Can be same source or second source. 3) Recovery \pm 15% of true value	NO	Recalibrate/Re-analyze all samples since last compliant CCV	Report non-conformances in narrative.
Continuing Calibration Blank (CCB)	Evaluation of instrument drift, sensitivity, and contamination.	1) Every 10 samples immediately after CCV. 2)) Matrix matched with standards and samples. 3) CCB must be < RL	NO	Recalibrate/Re-analyze all samples since last compliant CCB	Report non-conformances in narrative.

Notes:

State of Connecticut Department of Environmental Protection Recommended Reasonable Confidence Protocols
Quality Assurance and Quality Control Requirements Determination of Total Cyanide By SW-846 Methods
9010/9012/9014 Version 2.0 July 2006

* Refers to latest promulgated version of SW-846 Method 9010/9012/9014

r = Correlation Coefficient

RPD = Relative Percent Difference

%RSD = Relative Percent Standard Deviation

N/A = Not Applicable

Method CTETPH

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Retention Time Windows	Accurate identification of ETPH	1) Use the average RT of the C9 and C36 peaks of the initial calibration to establish the RT window.	NO	N/A	N/A
Initial Calibration	Laboratory Analytical Accuracy	1) Minimum of 5 standards per ETPH method. 2) Low std at reporting limit 3) % RSD must be $\leq 30\%$ or if linear regression used " r " ≥ 0.990 4) Quantitation by average CF/RF or by linear regression. 5) Curves must be verified with independent ICV prior to sample analysis. 6) Must perform discrimination check.	NO	Recalibrate as required by the method. Perform injection port maintenance if discrimination check fails. Labs are allowed one compound out of criteria for the discrimination chk.	Sample analysis cannot proceed without a valid initial calibration. Report non-conformances in narrative.
Continuing Calibration (CCAL)	Laboratory Analytical Accuracy	1) Prior to sample analysis and every 12-hours 2) Concentration near mid-point of curve. 3) Percent difference or drift $\pm 30\%$. 4) Verify all analytes fall in retention time windows. 5) Perform discrimination check	NO	1) Perform instrument maintenance, reanalyze CCAL and/or recalibrate. Labs are allowed one compound out of criteria for the discrimination chk.	Report exceedances in narrative.
Discrimination check	Laboratory Analytical Accuracy & Instrument Performance	1) After initial calibration and at beginning of 12-hour sequence prior to any sample analysis. 2) As per Section 7.2.3 of the ETPH method.	YES	1) Perform instrument maintenance, reanalyze CCAL and/or recalibrate. 2) One compound can be out as long as %D $\leq 50\%$.	Report exceedances in narrative.

Notes:

State Of Connecticut Department of Environmental Protection Recommended Reasonable Confidence Protocols Quality Assurance and Quality Control Requirements For Extractable Petroleum Hydrocarbons by the State of Connecticut, Department of Public Health ETPH Method, Version 2.0 July 2006

* Refers to latest published version of the CT-ETPH Method.

r = Correlation Coefficient

N/A = Not Applicable

RPD = Relative Percent Difference

%RSD = Relative Percent Standard Deviation

CF = Calibration Factor

Method 8082 – PCBs

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Retention Time Windows	Accurate identification of Pesticides	1) Prior to or during the initial calibration when a new column is installed. 2) Calculate according to Method 8000, Section 7.6.	NO	N/A	N/A
Initial Calibration	Laboratory Analytical Accuracy	1) Minimum of 5 stds (Note 1). 2) Low std at or below reporting limit. 3) % RSD must be $\leq 20\%$ or if linear regression used " r " ≥ 0.990 4) 5-point cal for AR-1016/1260. Single point for other Aroclors at mid-point within 12-hrs of sample analysis. If congeners are determined, must use 5-point for each congener. 5) If curves are used, curve must NOT be forced through origin. 6) Curves must be verified with independent ICV prior to sample analysis.	NO	Recalibrate as required by the method.	Sample analysis cannot proceed without a valid initial calibration. Report non-conforming compounds in narrative. If avg CF or linear regression not used (e.g. quadratic equation), must note list of affected compounds in narrative
Continuing Calibration (CCAL)	Laboratory Analytical Accuracy	1) Prior to samples, every 12-hours or 20 samples, whichever is more frequent, and at the end of the analytical sequence. 2) Concentration near mid-point of curve using AR-1016/1260. Congeners; CCAL must include all congeners. 3) Percent difference or drift $\leq 15\%$. 4) Verify all analytes fall in retention time windows.	NO	1) Perform instrument maintenance, reanalyze CCAL and/or recalibrate. 2) Reanalyze associated samples if beginning or closing CCAL exhibited low response and associated pesticides not detected in samples. 3) Reanalyze associated samples if beginning or closing CCAL high and associated pesticides were detected in samples.	Report exceedances in narrative. Note: Associated samples means all samples analyzed since the last acceptable CCAL.

Notes:

State of Connecticut Department of Environmental Protection Recommended Reasonable Confidence Protocols Quality Assurance and Quality Control Requirements Polychlorinated Biphenyls by Method 8082, SW-846 Version 2.0 July 2006

* Refers to latest promulgated version of SW-846 Method 8082.

r = Correlation Coefficient

GC/MS = Gas Chromatography/Mass Spectrometry

RPD = Relative Percent Difference

Notes: (cont.)

CCC = Calibration Check Compound

N/A = Not Applicable

%RSD = Relative Percent Standard Deviation

CF = Calibration Factor

EP = Environmental Professional

Note 1: Six standards are required for a quadratic equation calibration curve, and seven are required for a polynomial fit. In either case the correlation coefficient must be ≥ 0.990 .

10. Form J – Sample Handling and Custody Requirements

Detailed sample handling and custody standard operating procedures are provided in Appendix A - SOP FD-003. Upon collection, all samples will be placed into the appropriate containers and clearly labeled with the company name, job number, date, and sample identification (e.g. location, depth, etc.). Labeled samples will be immediately placed into ice, or freeze pack-chilled coolers, which will be stored at designated locations under the custody of field personnel until transport from the Site to the TestAmerica Laboratory, either by field personnel or courier.

All samples will be tracked via chain of custody forms. A sample TestAmerica Chain of Custody is provided in Appendix C. Each individual taking custody of the samples must sign the chain of custody at the time of transfer, until the samples are formally received by TestAmerica. The original chain of custody will remain with the sample throughout the duration of the sampling event and will be kept in the permanent project file. Copies of the chain of custody will be distributed to the working project file, laboratory manager, and the data package.

At the laboratory the samples will be relinquished to the Sample Custodian with the signing of the chain of custody. The samples are visually inspected for damage and label correctness. Each sample is assigned an individual laboratory sample number. Samples are logged into the “B” sample log-in book (the environmental sample log book). The login includes the lab number, client, date, matrix, preservation, parameters, and laboratory batch identification. This information along with the log-in date and time, submitter identification, laboratory due date and priority, date sampled, date received, receiver, and any other appropriate laboratory information is then input into the Laboratory Information Management System (LIMS). A form is generated by LIMS and the original chain of custody is attached. Samples are then preserved if necessary and then transferred to refrigerators pending analysis. Analysis is performed by the appropriate analyst or supervisor. After analysis is complete samples are transferred to disposal storage and held for two months in case further testing is required. Samples are appropriately characterized and disposed of in accordance with Federal, State, and Local regulations.

Holding times for various parameters are specific in the most recent “Methods for Evaluating Solid Waste, Physical/Chemical Methods”, 3rd Edition, U.S. EPA, November 1986, (SW846) promulgated method for the requisite analytical parameter. Questions on holding times will be directed to TestAmerica Laboratory. Holding times for this project are provided in Form F-2 of this document.

11. Form K – Analytical Sensitivity and Project Criteria

Table 3 provides an analytical method sensitivity and project criteria table for the methods that will be routinely performed on this project.

12. Form L – Field Quality Control

All equipment used for sample collection and compositing will be decontaminated before use in accordance with SOP QA-001. The decontamination procedures consist of:

- Non-phosphate detergent and tap water wash (e.g., Alconox);
- Tap water rinse;
- 10% nitric acid rinse;
- Deionized water rinse;
- Methanol rinse;
- Deionized water rinse; and
- Air dry.

The decontamination location will be determined for each site, and may be conducted at various on-site locations as sampling progresses. The current approach to analytical controls with regards to field blanks, equipment rinseate blanks, duplicate samples, and trip blanks includes the following:

QC Sample	Frequency	Acceptance Criteria	Corrective Action
Duplicate	1 per every 20 samples	Duplicate concentrations are within $\pm 30\%$ for water and $\pm 50\%$ for soil/sediment of original sample	Rerun sample Flag in data report
Equipment Blank	1 for each type of non-dedicated field equipment	No contaminants are detected	Rerun sample Flag in data report
Field Blank	1 per day	No contaminants are detected	Flag in data report
VOA Trip Blank	1 per cooler with VOA vials/day	No contaminants are detected	Flag in data report
Temperature Blank	1 per cooler	Samples kept at 4°C or cooler	

13. Form M – Laboratory Quality Control

Method 8260B Volatile Organic Compounds

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Method Blanks	Laboratory Contamination Evaluation	1) Every 12-hrs shift or 20 samples, whichever is more frequent, prior to sample analysis and after calibration standards. 2) Matrix and preservative-specific (e.g. water, MeOH, NaHSO ₄) 3) Target analytes must be <RL except for common lab contaminants which must be <3x the RL (Contaminants are acetone, methylene chloride, and 2-butanone)	YES	Locate source of contamination and correct problem. Reanalyze method blank.	1) Report non-conformances in case narrative. 2) All results for compounds present in method blank must be "B" flagged if detected in samples associated with the method blank.
Laboratory Control Sample (LCS)	Laboratory Method Accuracy	1) Every 20 samples/matrix or for each new tune clock, whichever is more frequent. 2) Concentration level must be near or at the mid-point of the initial calibration. 3) Must contain all target analytes 4) Matrix and preservative specific (e.g. water, MeOH, NaHSO ₄) 5) Laboratory determined percent recoveries must be between 70-130% for target compounds 6) Can also be used as CCAL 7) Lab may have up to 10% of compounds out of criteria as long as within 40-160% recovery. 8) Laboratories may spike blank soil or water for LCS (No 2 nd source requirement)	YES	Recalculate the percent recoveries Reanalyze the LCS Locate & correct problem, reanalyze associated samples	1) Report non-conformances in case narrative. 2) Individual laboratories must identify and document problem analytes which routinely fall outside the 70-130% limit. Any exceedances must be noted in narrative. Data to support laboratory problem compounds kept on file at lab for review during audit.

Method 8260B Volatile Organic Compounds (cont.)

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Matrix Spike/Matrix Spike Duplicates (MS/MSD)	Method Accuracy in Sample Matrix Method Precision in Sample Matrix	1) Every 20 samples (Site specific MS/MSD's are strongly recommended 2) Matrix Specific, not required for trip blanks or field blanks 3) Must contain all target analytes 4) Laboratory determined percent recoveries should be between 70-130% for target compounds 5) RPD's should be \leq 30% 6) Field blanks, trip blanks, etc. cannot be used for MS/MSDs.	YES (When requested)	Compare to LCS recoveries, narrate any non-conformances	Report non-conformances in case narrative
Surrogates	Accuracy in Sample Matrix	1) A minimum of 3 surrogates must be added to all samples, blanks, etc. prior to sample introduction 2) Evaluate recoveries in each sample 3) Laboratory determined percent recoveries must be between 70-130% for individual surrogate compounds. Laboratory determined recovery limits may be outside 70-130% limits for difficult matrices (e.g. waste, sludges, etc.) 4) Single point calibration allowed for surrogates. See Note 1.	YES	If one or more surrogates are outside limits, reanalyze the sample unless one of the following exceptions occurs: 1) For methanol preserved samples reanalysis is not required if moisture >25% and recoveries are >10%. 2) If one surrogate exhibits high recovery and associated target compounds are not detected in the sample, report data as is, no reanalysis required.	1) Note exceedances in narrative. 2) If reanalysis confirms matrix interference, report both sets of results and note in narrative. 3) If reanalysis performed in holding time and surrogate recoveries are in range, report only the compliant data. 4) If reanalysis performed outside of holding time and surrogate recoveries are in range, report both sets of data, note in narrative.

Method 8260B Volatile Organic Compounds (cont.)

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Internal Standards (IS)	Laboratory Analytical Accuracy and Method Accuracy in Sample	1) Laboratory must use a minimum of 3 IS at retention times across the GC run. 2) Area counts in samples must be within -50% to +100% of the area counts in the associated CCAL. 3) Retention times of IS must be within ± 30 seconds of the IS retention times in the associated CCAL.	NO	If any IS is outside the QC limits, reanalyze the sample.	1) Note exceedances in narrative. 2) If reanalysis confirms matrix interference, report both sets of results and note in narrative. 3) If reanalysis performed in holding time and IS are in criteria, report only the compliant data. 4) If reanalysis performed outside of holding time and IS are in criteria, report both sets of data, note in narrative.
Quantitation	N/A	1) Quantitation must be based on IS calibration 2) The laboratory must use the average RF or linear regression from the initial calibration for quantitation of each analyte 3) The IS used for quantitation must be the IS nearest to the retention time of the target analyte.	N/A	N/A	1) If the average RF or linear regression was not used for analyte quantitation (e.g. quadratic equation), it must be noted in the narrative along with a list of affected analytes. 2) Laboratories must supply example calculations for those cases where the average RF or linear regression was not used.

Method 8260B Volatile Organic Compounds (cont.)

Required QA/QC Parameter	Data Quality Objective	Required Performance Standard
General Reporting Issues	N/A	1) The laboratory should report only concentrations detected above the sample specific RL. 2) Concentrations below the reporting limit (RL) as "ND" with the reporting limit. 3) Dilutions: If diluted and undiluted analyses are performed, the laboratory should report results for both sets of data. Compounds which exceed the linear range should be flagged ("E" flag). Do not report more than 2 sets of data per sample. 4) If a dilution is performed, the highest detected analyte must be in the upper 60% of the calibration curve, unless there are non-target analytes whose concentrations are so high as to cause damage to the instrumentation or saturate the mass spectrometer. 5) Refer to Appendix A for guidance on reporting TIC's.

Notes:

State of Connecticut Department of Environmental Protection Recommended Reasonable Confidence Protocols Quality Assurance and Quality Control Requirements Volatile Organics by Method 8260, SW-846 Version 3.0 July 2006

* Refers to latest published version of SW-846 Method 8260.

r = Correlation Coefficient

GC/MS = Gas Chromatography/Mass Spectrometry

RPD = Relative Percent Difference

BFB = 4-Bromofluorobenzene

CCC = Calibration Check Compound

%RSD = Relative Percent Standard Deviation N/A = Not Applicable

RF = Relative Response Factor

EP = Environmental Professional

Potentially Difficult Compounds include acetone, bromomethane, chloroethane, dichlorodifluoromethane, dibromochloromethane, hexachlorobutadiene, 2-butanone (MEK), 4-methyl-2-pentanone, and trichlorofluoromethane.

Note 1: Six standards are required for a quadratic equation calibration curve, and seven are required for a polynomial fit. In either case the correlation coefficient must be ≥ 0.990 . Surrogates may be calibrated using a single point, at the same concentration as added to all samples, blanks, etc.

Method 8270 Semivolatile Organic Compounds

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Method Blanks	Laboratory Contamination Evaluation	1) Extracted every 20 or every batch, whichever is more frequent. 2) Matrix specific. 3) Target analytes must be <RL except for common lab contaminants which must be <3x the RL (Contaminants are phthalates).	YES	Locate source of contamination and correct problem. Reanalyze method blank.	1) Report non-conformances in case narrative. 2) All results for compounds present in method blank must be "B" flagged if detected in samples associated with the method blank. 3) If re-extraction performed within holding time, report only compliant data. If re-extraction performed outside holding time report all data
Laboratory Control Sample (LCS)	Laboratory Method Accuracy	1) Every 20 samples or each batch, whichever is more frequent. 2) Concentration level must be near or at the mid-point of the initial calibration. 3) Must contain all target analytes 4) Matrix and preservative specific 5) Laboratory determined percent recovery limits must be between 40-140% for base-neutrals and 30-130% for acid compounds. 6) Laboratories may spike blank soil or water for LCS.	YES	Recalculate the percent recoveries. Reanalyze the LCS . Re-extract LCS and samples if >20% compounds outside acceptance criteria. Locate & correct problem, reanalyze associated samples.	1) Report non-conformances in case narrative. 2) Individual laboratories must identify and document problem analytes which routinely fall outside the limits. Any exceedances must be noted in narrative. Data to support laboratory problem compounds kept on file at lab for review during audit 3) If re-extraction performed within holding time, report only compliant data. If re-extraction performed outside holding time report all data.

Method 8270 Semivolatile Organic Compounds (cont.)

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Site Specific Matrix Spike/ Matrix Spike Duplicate	Precision and Accuracy in Sample Matrix	1) Every 20 samples per matrix. 2) Spike concentration in lower part of calibration curve. 3) Must contain all target analytes. 4) Laboratory determined percent recovery limits must be between 40-140% for base-neutrals and 30-130% for acid compounds. 5) RPD's $\leq 20\%$ for waters and $\leq 30\%$ for soils.	YES (If analyzed)	If compounds out, compare to LCS; if LCS recoveries in note in narrative; if LCS compounds out note in narrative probable lab error.	Note outliers in narrative.
Internal Standards	Laboratory and Method Accuracy in Sample Matrix	1) Full Scan Minimum of six IS's across GC run. SIM: Number of IS's will vary depending on number of analytes of interest. IS's must elute reasonably close to analytes and of similar class. 2) Area counts -50 to $+100\%$ of areas in associated continuing cal check. 3) Retention times of IS's ± 30 seconds of associated continuing cal check.	NO	If any IS outside criteria, reanalyze sample extract.	1) Note exceedances in narrative. 2) If reanalysis confirms matrix interference report all results. 3) If reanalysis does not confirm matrix interference, report only compliant data. 4) If reanalysis outside holding time, report both sets of data.
Surrogates	Accuracy in Sample Matrix	1) Minimum 3 base-neutral and 3 acid surrogates across retention times of GC run. See Table 2B for recommended compounds. 2) Soil recovery limits lab generated and within 30-130%. 3) Water recovery limits lab generated and within 30-130% for base-neutrals, 15-110% for acidic compounds.	YES	Allowed one acid or one base-neutral surrogate out as long as above 10% rec. If any one surrogate $<10\%$ rec or if any two in a fraction out, re-extract. If surrogate diluted out below lowest calibration std, no recovery criteria.	1) Note exceedances in narrative. 2) If re-extraction confirms matrix interference or if re-extraction outside holding times report all results. 3) If re-extraction results in criteria and in holding time, report only compliant data.

Method 8270 Semivolatile Organic Compounds (cont.)

QA/QC Parameter	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Quantitation	N/A	1) Quantitation must be based on IS method. 2) Laboratory must use average RF or linear regression from initial calibration. 3) IS used for quantitation closest eluting to analyte.	N/A	N/A	If the average RF or linear regression not used for quantitation (e.g. quadratic equation) lab must note in narrative with list of affected analytes. Quadratic or polynomial fits require 6 & 7 calibration points.
General Reporting Issues	N/A	1) The laboratory should report only concentrations detected above the sample specific RL. 2) Concentrations below the reporting limit (RL) should be reported as "ND" with the sample specific RL also reported 3) Dilutions: If diluted and undiluted analyses are performed, the laboratory should report results for both sets of data. Compounds which exceed the linear range should be flagged ("E" flag). Do not report more than two sets of data per sample. 4) If a dilution is performed, the highest detected analyte must be in the upper 60% of the calibration curve, unless there are non-target analytes whose concentrations are so high as to cause damage to the instrumentation or saturate the mass spectrometer	N/A	N/A	1) Qualification of results reported below the RL is required. 2) Performance of dilutions must be documented in the case narrative 3) TIC's will be evaluated according to Appendix A.

Notes:

Source: State of Connecticut Department of Environmental Protection Recommended Reasonable Confidence Protocols Quality Assurance and Quality Control Requirements Semivolatile Organics by Method 8270, SW-846 Version 2.0 July 2006

* Refers to latest published version of SW-846 Method 8270. r = Correlation Coefficient

GC/MS = Gas Chromatography/Mass Spectrometry RPD = Relative Percent Difference

DFTPP = Decafluorotriphenylphosphine CCC = Calibration Check Compound

%RSD = Relative Percent Standard Deviation N/A = Not Applicable

EP = Environmental Professional

Note 1: Six standards are required for a quadratic equation calibration curve, and seven are required for a polynomial fit. In either case the correlation coefficient must be ≥ 0.990 . Potentially Difficult Compounds include dimethyl phthalate, 4-nitrophenol, phenol, 4-methylphenol, 2-methylphenol, 2,4-dinitrophenol, pentachlorophenol, and 4-chloroaniline.

Method 6010 Trace Metals

QA/QC Parameter	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Method Blanks	Laboratory Contamination Evaluation	1) Digested every 20 or every batch, whichever is greater. If no digestion, ICB = blank 2) Matrix specific and matrix matched 3) Target analytes must be <RL	YES	Locate source of contamination and correct problem. Reanalyze method blank. Reprep sample unless all analyte concentration >10x method blank level	1) Report non-conformances in case narrative.
Laboratory Control Sample (LCS)	Laboratory Method Accuracy	1) Every 20 samples or each batch, whichever is more frequent. If samples not digested, ICV = LCS 2) Matrix specific (solid, aqueous, etc). 3) LCS recoveries $\pm 20\%$ for aqueous media and within vendor control (95% confidence limits) for solids.	YES	Redigest and reanalyze all samples.	Report non-conformances in narrative.
Site Specific Matrix Spike	Accuracy in Sample Matrix	1) Every 20 samples or batch per matrix* 2) Percent recovery limits must be between 75-125%.	Yes* (*If analyzed)	If recoveries >30% and LCS in limits note in narrative If MS recoveries <30%, reprepare and reanalyze samples	Note outliers in narrative.
Site Specific Matrix Duplicate (Lab may elect to analyze MSD instead)	Precision in Sample Matrix	1) Every 20 samples or batch per matrix* 2) For aqueous samples, if concentration >5x the RL, RPD <20%. If concentration <5x RL, difference $\pm RL$. 3) For solids if conc >5x RL, RPD <35%. If conc. < 5x RL, difference $\pm 2x RL$	Yes* (*If analyzed)	If LCS in criteria, narrate outliers.	Note outliers in narrative.

Method 6010 Trace Metals (cont.)

QA/QC Parameter	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Linear Range Determination	Laboratory Method Accuracy	1) Performed at least annually 2) Determine upper limit of linear dynamic range for each wavelength utilized as per method.	NO	N/A	Data must be on-file to document performance.
Inter-element correction factors (IEC's)	Laboratory Method Accuracy	1) Verify every six months 2) Routine analysis of ICSA and ICSAB verifies inter-element spectral interference corrections – See method for details	NO	Adjust software settings.	Data must be on-file to document performance.
General Reporting Issues	N/A	1) The laboratory should report only concentrations detected above the sample specific RL. 2) Concentrations below the reporting limit (RL) should be reported as "ND" with the sample specific RL also reported 3) Dilutions: If analytes above linear range, dilute and reanalyze for those analytes. 4) Soils/sediments reported on a dry weight basis.	N/A	N/A	

Notes:

State of Connecticut Department of Environmental Protection Recommended Reasonable Confidence Protocols
Quality Assurance and Quality Control Requirements Determination of Trace Metals By SW-846 Method 6010
Inductively Coupled Plasma-Atomic Emission Spectrometry ,Version 2.0 , July 2006

* Refers to latest promulgated version of SW-846 Method 6010.

r = Correlation Coefficient

RPD = Relative Percent Difference

%RSD = Relative Percent Standard Deviation

N/A = Not Applicable

Method 7470 Mercury*

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Method Blanks	Laboratory Contamination Evaluation	1) Digested every 20 or every batch, whichever is greater. 2) Matrix specific and matrix matched 3) Mercury must be <RL	YES	Locate source of contamination and correct problem. Reprepare samples unless all analyte concentration >10x method blank level	Report non-conformances in case narrative.
Laboratory Control Sample (LCS)	Laboratory Method Accuracy	1) Every 20 samples or each batch, whichever is more frequent 2) Standard source can be initial calibration source. 3) Matrix specific (solid, aqueous, etc). 4) LCS recoveries $\pm 20\%$ for aqueous media and within vendor control (95% confidence limits) for solids.	YES	Redigest and reanalyze all samples.	Report non-conformances in narrative.
Site Specific Matrix Spike	Accuracy in Sample Matrix	1) Every 20 samples or batch per matrix* 2) Percent recovery limits must be between 75-125%.	Yes* (*If analyzed)	If recoveries >30% and LCS in limits note in narrative If MS recoveries <30%, reprepare and reanalyze samples	Note outliers in narrative
Site Specific Matrix Duplicate (Lab may substitute MSD in lieu of sample duplicate)	Precision in Sample Matrix	1) Every 20 samples or batch per matrix* 2) For aqueous samples RPD $\pm 20\%$ if conc. >5x the RL. If conc. < 5x RL, the limit is \pm RL 3) For solids RPD $\pm 35\%$ if conc >5x the RL. If conc. < 5x the RL, limit is \pm the RL.	Yes* (*If analyzed)	If LCS in criteria, narrate outliers.	Note outliers in narrative

Notes:

State of Connecticut Department of Environmental Protection Recommended Reasonable Confidence Protocols
Quality Assurance and Quality Control Requirements Determination of Mercury By SW-846 Methods 7470/7471
Cold Vapor Atomic Absorption Spectroscopy Version 2.0 July 2006.

* Refers to latest published version of SW-846 Method 7470/7471.

r = Correlation Coefficient

RPD = Relative Percent Difference EP = Environmental Professional

%RSD = Relative Percent Standard Deviation N/A = Not Applicable

Method 9010 Cyanide*

QA/QC Type	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Method Blanks	Laboratory Contamination Evaluation	1) Digested every 20 or every batch, whichever is greater. 2) Matrix specific and matrix matched 3) Cyanide must be <RL	YES	Locate source of contamination and correct problem. Reprep samples unless all detected analyte concentration >10x method blank level	Report non-conformances in case narrative.
Laboratory Control Sample (LCS)	Laboratory Method Accuracy	1) Every 20 samples or each batch, whichever is more frequent 2) Standard source different from initial calibration source. 3) Matrix specific (solid, aqueous, etc). 4) LCS recoveries $\pm 20\%$ for aqueous media and within vendor control (95% confidence limits) for solids.	YES	Redigest and reanalyze all samples.	Report non-conformances in narrative.
Site Specific Matrix Spike	Accuracy in Sample Matrix	1) Every 20 samples or batch per matrix** 2) Percent recovery limits must be between 75-125%.	Yes** (If analyzed)	None	Note outliers in narrative
Site Specific Matrix Duplicate	Precision in Sample Matrix	1) Every 20 samples or batch per matrix** 2) For aqueous samples RPD $\leq 20\%$ 3) For solids RPD $\leq 35\%$	Yes** (If analyzed)	If LCS in criteria, narrate outliers.	Note outliers in narrative
General Reporting Issues	N/A	1) The laboratory should report only concentrations detected above the sample specific RL. 2) Concentrations below the reporting limit (RL) should be reported as "ND" with the sample specific RL also reported 3) Dilutions: If analyte above linear range, dilute and reanalyze for those analytes. 4) Soils/sediments reported on a dry weight basis. 5) RL must be verified daily with a low level calibration standard the RL. Must be part of initial calibration.	YES	N/A	

Notes:

State Of Connecticut Department of Environmental Protection Recommended Reasonable Confidence Protocols
Quality Assurance and Quality Control Requirements Determination of Total Cyanide By SW-846 Methods
9010/9012/9014 Version 2.0 July 2006

* Refers to latest promulgated version of SW-846 Method 9010/9012/9014

r = Correlation Coefficient

RPD = Relative Percent Difference

%RSD = Relative Percent Standard Deviation

N/A = Not Applicable

Method CT-ETPH*

Required QA/QC Parameter	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Method Blanks	Laboratory Contamination Evaluation	1) Extracted every 20 samples or every batch, whichever is greater. 2) Matrix specific 3) Target analytes must be <RL	YES	Locate source of contamination and correct problem. Reanalyze method blank. Re-extract samples if method blank contaminated	1) Report non-conformances in case narrative. 2) All results for compounds present in method blank above RL must be "B" flagged if detected in samples associated with the method blank. 3) If re-extraction performed within holding time, report only compliant data. If re-extraction performed outside holding time report all data.
Laboratory Control Sample (LCS)	Laboratory Method Accuracy	1) Every 20 samples or each batch, whichever is more frequent. 2) Standard source different from initial calibration source. 3) Concentration level must be near or at the mid-point of the initial calibration. 4) Matrix specific. 5) Laboratory determined percent recovery limits must be between 60-120%	YES	Recalculate the percent recoveries Reanalyze the LCS If MS/MSD in same batch compare to determine if problem isolated to LCS Locate & correct problem, reanalyze associated samples	1) Report non-conformances in case narrative. 2) If re-extraction performed within holding time, report only compliant data. If re-extraction performed outside holding time report all data.
Site Specific Matrix Spike/Matrix Spike Duplicate	Precision and Accuracy in Sample Matrix	1) Every 20 samples per matrix* 2) Spike concentration in lower part of calibration curve. 3) Laboratory determined percent recovery limits must be between 50-150% 5) RPD's \leq 30%	Yes* (*If requested by EP)	If compounds out compare to LCS; if LCS recoveries in note in narrative; if LCS compounds out note in narrative probable lab error	Note outliers in narrative
Surrogates	Accuracy in Sample Matrix	1) Minimum 1 surrogate 2) Recovery limits lab generated and within 50-150%. 3) Labs must develop own in-house limits which fall within 50-150% limits.	Yes	1) If surrogate diluted out below lowest calibration std, no recovery criteria. 2) If obvious matrix interference, note in narrative	1) Note exceedances in narrative.

Method CT-ETPH* (cont.)

Required QA/QC Parameter	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
General Reporting Issues	N/A	1) The laboratory should report only concentrations detected above the sample specific RL. 2) Concentrations below the reporting limit (RL) should be reported as "ND" with the sample specific RL also reported 3) If a dilution is performed, the ETPH concentration must be in the upper 60% of the calibration curve, unless there are non-target analytes whose concentrations are so high as to cause damage to the instrumentation	N/A	N/A	1) Performance of dilutions must be documented in the case narrative

Notes:

State of Connecticut Department of Environmental Protection Recommended Reasonable Confidence Protocols Quality Assurance and Quality Control Requirements For Extractable Petroleum Hydrocarbons by the State of Connecticut, Department of Public Health ETPH Method, Version 2.0 July 2006

* Refers to latest published version of the CT-ETPH Method.

r = Correlation Coefficient

N/A = Not Applicable

RPD = Relative Percent Difference

%RSD = Relative Percent Standard Deviation

CF = Calibration Factor

EP= Environmental Professional

Method 8082 – PCBs

Required QA/QC Parameter	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Method Blanks	Laboratory Contamination Evaluation	1) Extracted every 20 samples or every batch, whichever is greater. 2) Matrix specific 3) Target analytes must be <RL	YES	Locate source of contamination and correct problem. Reanalyze method blank. Re-extract samples if method blank contaminated	1) Report non-conformances in case narrative. 2) All results for compounds present in method blank above RL must be "B" flagged if detected in samples associated with the method blank. 3) If re-extraction performed within holding time, report only compliant data. If re-extraction performed outside holding time report all data.
Laboratory Control Sample (LCS)	Laboratory Method Accuracy	1) Every 20 samples or each batch, whichever is more frequent. 2) Standard source different from initial calibration source. 3) Concentration level must be near or at the mid-point of the initial calibration. 4) LCS with AR-1016/1260. Congeners must contain all target congeners. 5) Matrix specific. 6) Laboratory determined percent recovery limits must be between 40-140%. 7) Labs are required to develop own in-house limits that meet or exceed limits listed above.	YES	Recalculate the percent recoveries Reanalyze the LCS If MS/MSD in same batch compare to determine if problem isolated to LCS Re-extract LCS and samples if >10% compounds outside acceptance criteria and no MS/MSD with acceptable criteria Locate & correct problem, reanalyze associated samples	1) Report non-conformances in case narrative. 2) If re-extraction performed within holding time, report only compliant data. If re-extraction performed outside holding time report all data.

Method 8082 – PCBs (cont.)

Required QA/QC Parameter	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Site Specific Matrix Spike/Matrix Spike Duplicate	Precision and Accuracy in Sample Matrix	1) Every 20 samples per matrix* 2) Spike concentration in lower part of calibration curve. 3) Usually contain AR-1016/1260 unless site specific Aroclor requested. 4) Laboratory determined percent recovery limits for AR-1016/1260 must be between 40-140%. Use 40-140% for other Aroclors. Congeners must contain all target congeners. 5) RPD's \leq 50% for Aroclors, \leq 30% for congeners.	Yes* (*If requested by EP)	If compounds out compare to LCS; if LCS recoveries in note in narrative; if LCS compounds out note in narrative probable lab error	Note outliers in narrative
Surrogates	Accuracy in Sample Matrix	1) Minimum 2 compounds across retention times of GC run. Recommended compounds Tetrachloro-m-xylene and decachlorobiphenyl. 2) Recovery limits lab generated and within 30-150% for both compounds on both columns. 3) Labs must develop own in-house limits that fall within 30-150% limits.	Yes	If the same surrogate outside limits on both columns, re-extract sample. If both surrogates outside limits on one column only, reanalyze sample. If surrogate diluted out below lowest calibration std, no recovery criteria.	1) Note exceedances in narrative. 2) If re-extraction or reanalysis confirms matrix interference or if re-extraction outside holding times report all results. 3) If re-extraction or reanalysis results in criteria and in holding time, report only compliant data.

Method 8082 – PCBs (cont.)

Required QA/QC Parameter	Data Quality Objective	Required Performance Standard	Required Deliverable	Recommended Corrective Action	Analytical Response Action
Identification and Quantitation	Inter-laboratory Consistency	<p>1) Laboratory must use a minimum of 3 peaks. Peaks selected must be $\geq 25\%$ of height of largest aroclor peak.</p> <p>2) Aroclors: Laboratory should use the average calibration factor for each of the peaks from each concentration level to quantitate Aroclors 1016 and 1260. Laboratory should use the average calibration factor for each of the peaks from single point standard to quantitate remaining Aroclors (when only single-point standard analyzed). If 5-point calibration performed for other Aroclors, follow procedure for 1016 and 1260. Calculate concentration of Aroclor using each individual peak and calculate the average concentration of the three results to obtain the final Aroclor concentration.</p> <p>Congeners: Laboratory should use the average response factor of each congener.</p> <p>3) Second column analysis: Laboratory must utilize a second dissimilar column to confirm all positive results above the RL. Report the higher of the two analyses. The QA/QC parameters in this document must be met for both columns</p>	NO	N/A	<p>1) If the RPD between the results for the two columns exceeds 40%, the laboratory must flag the results with a "P" suffix and note in narrative.</p> <p>2) If avg Rf or linear regression not used (e.g. quadratic equation), must note list of affected compounds in narrative.</p> <p>Note: If a high RPD between the two columns can be definitely attributed to a matrix interference, report the lower value and note in the narrative with an explanation.</p>

Notes:

State of Connecticut Department of Environmental Protection Recommended Reasonable Confidence Protocols
Quality Assurance and Quality Control Requirements Polychlorinated Biphenyls by Method 8082, SW-846
Version 2.0 July 2006

* Refers to latest promulgated version of SW-846 Method 8082.

r = Correlation Coefficient

GC/MS = Gas Chromatography/Mass Spectrometry

RPD = Relative Percent Difference

CCC = Calibration Check Compound

N/A = Not Applicable

%RSD = Relative Percent Standard Deviation

CF = Calibration Factor

EP = Environmental Professional

14. Form N – Data Management and Documentation

The following deliverables will be provided by the field personnel:

- A permanently bound notebook with individually numbered pages is maintained for field sampling. Further discussion of field note taking is provided in SOP RE-001.
- All entries into the notebook are made with permanent ink, and corrections are made using a single line through the mistake with the initials and date of the individual who made them. Entries include persons present, sampling location, time/date, weather conditions, and any problem encountered during sampling.

The following deliverables will be provided by the laboratory:

- Reporting will be performed in accordance with CTDEP “Reasonable Confidence Protocols” for laboratory reporting.
- Samples data results sheets for all sample, equipment/rinseate blanks and trip blanks for VOCs;
- Surrogate recoveries and acceptance limits;
- Matrix spike/matrix spike duplicate results and acceptance limits;
- Duplicate sample results;
- Method/Reagent Blank results; and
- Calibration standards/Reference standards/Laboratory Fortified Blanks (LFB) reports.

The QA manager will be provided the laboratory reports directly from the laboratory. A summary or narrative of any deviation from the QC criteria will be provided to the QA manager. Also, observations about the samples including, but not limited to, missed holding times, laboratory blank contamination, and reference standards, will be reported.

The following deliverables will not be required, but will be maintained by the laboratory and may be requested at a later date:

- All raw data including chromatograms;
- Copies of Instrument logbooks; and
- Copies of internal chains of custody.

All reports are generated in hard copy form.

15. Form O – Assessments and Response Actions

Any deficiencies or problems encountered during this investigation require corrective action. No sampling or analytical assessments are currently planned to determine the need for response actions. However, regular consultation and site visits with project managers will be used to determine the quality of generated data. Table 1 provides percent completeness goals on a per AOC basis. Due to the uniformity of the sampling scheme, no individual sample is more important than another.

The project QA Officer will be notified immediately if any problems are encountered in the field. Based on the QA Officer's evaluation, minor deviations (e.g. those which are justified and will not have an adverse effect on the quality of data) may be approved at the project level and implemented. Major corrective action, such as encountering buried drums, require immediate notification of the EPA project manager prior to proceeding with the field investigation.

The laboratory must maintain its certification with the state of Connecticut throughout the course of the project. (See Lab Quality Assurance Manual for a description of the routine systems audits in which the lab participates).

The project QA officer will be responsible for identifying and reporting any deficiencies or problems. Any problems or deficiencies reported by telephone or in person to the QA officer will be documented on a telephone/personal conversation report form. Any problems or deficiencies reported in the field will be documented in the field notebook. Any corrective actions required will be documented in the field notebook.

16. Form P – Project Reports

The work conducted for this program will be presented in a report prepared by GEI. The report will summarize the findings of the investigation with an emphasis on the current environmental condition of the site and recommendations for additional work and/or interim measures. The text will be supported by exploration logs, analytical data, summary tables, and figures showing exploration locations, ground water contours, and contaminant distribution, as appropriate. The report will also provide:

- Modifications to the site conceptual model based on recent investigation results.
- Recommendations for additional work and/or interim measures (IM) including an IM work plan.
- Details of any new release areas discovered beyond those identified in previous investigations. EPA and CTDEP will be notified within 15 days of the discovery of a new release.
- Revisions to the schedule of events.
- Statements regarding data quality and the impact of data problems on the usability of the data. This will include quality problems found and corrective actions taken.

17. Form Q – Field Data Evaluation

The sampling procedures will be recorded in the field on the designated field data sheets. The field data sheet will be reviewed to ensure the following information is properly documented:

- Sample identification;
- Field QA/QC sample identification (e.g. field duplicates, field blanks);
- Source;
- Date of sampling;
- Sampling equipment;
- Sampler(s); and,
- Results of any field monitoring or observations.

The sample handling procedures for each sample will be recorded on the chain-of-custody form. The chain-of-custody form will be reviewed to ensure the following information is properly documented:

- Sample identification;
- Number of sample containers;
- Preservatives used; and
- Signatures.

The review will be performed by the QA officer.

18. Form R – Laboratory Data Evaluation

Where applicable the field and laboratory-derived data will be verified using the CTDEP *Laboratory Quality Assurance and Quality Control Guidance Reasonable Confidence Protocols* dated November 2007. In addition, the laboratory will perform internal validation procedures as per their SOPs.

The QA Manager will perform a Tier II validation of the laboratory data deliverables received from the laboratory. The following tasks will be performed and documented in the validation section of the final site activities report. A discussion will also be provided that includes any observations and conclusions about the quality of the data and any limitations on the way it should be used.

A. Summary of Technical Usability

The QA Manager will identify and document the following:

- Laboratory and laboratory project number;
- Number of samples and sample field identifications (IDs) submitted to the laboratory by comparing the laboratory narrative to the chain-of-custody;
- The laboratory sample IDs; and
- List parameters analyzed by comparing the laboratory narrative to the chain-of-custody.

B. Technical Issues Affecting Accuracy

The QA Manager will review, document, and comment on:

- Sampling holding times compared to acceptable holding times;
- Laboratory control sample recoveries compared to acceptable laboratory control sample recoveries as established by the method standard operating procedures of the laboratory internal procedures; and
- Matrix spike recoveries compared to acceptable matrix spike recoveries as established by the method standard operating procedures of the laboratory internal procedures.

C. Technical Issues Affecting Precision and Representativeness

The relative percent differences (RPD) will be calculated between samples and sample duplicates and between matrix spikes and matrix spikes duplicates. The acceptable RPD for soil is an RPD<50% and the acceptable RPD for water is an RPD<30%.

D. Technical Issues Affecting Sensitivity

The QA manager will review and comment on any contaminants identified the following:

- Method blanks
- Equipment blanks
- Trip Blanks

The QA Manager will review the laboratory reported minimum detection limits (MDLs)

E. Summary of Completeness, Documentation, and Chain-of-Custody Issues

The QA Manager will review the data deliverables package for the following components:

- Laboratory narrative
- Data result sheets
- Method blank results
- Surrogate recoveries and acceptance limits
- Laboratory control sample results and acceptance limits
- Project narrative including all observations and deviations

If any sample or QC issues are documented in the narrative that are not included as part of the data package deliverables, the laboratory will be contacted, copies of relevant information obtained, and a discussion of any limitations on the use of the data will be presented in the validation section of the final reports. If the data deliverables package is incomplete, the laboratory will be contacted and requested to provide the missing documentation.

19. Form S – Data Usability and Project Evaluation

Evaluation of data usability will be based on a review of the data verification and DQO. Table 1 provides percent completeness goals on a per AOC basis. If the data are deemed to be useable, soil and groundwater results will be evaluated relative to the Connecticut Department of Environmental Protection Remediation Standard Regulations (Section 22a-133k of the Regulations of Connecticut State Agencies). Any data gaps and unusable data will be noted in subsequent reports.

An opinion statement will be included describing whether identified problems have a major or minor impact on data usability, and whether or not data quality objectives were achieved. A discussion will be included in the final report that will assess precision, accuracy and completeness and how these parameters affect the usability of the data.

Tables

Table 1
Summary of Analytical Samples - Solids
MacDermid, Inc.
526 Huntingdon Avenue
Waterbury, Connecticut

Solids Samples

Sample ID	Location	AOCs Covered	COCs								Rationale	Percent Completeness Goals
			VOCs Method 8260	SVOCs Method 8270	Metals Method 6010/7470 *	Cyanide Method 9010	ETPH Method CTETPH	PCBs Method 8082	Waste Char. Method Varies **			
SB-1	North Parcel - Cap	AOC-A	2		2	2	2				Characterize Material and Volume of Material	1 missed sample - 93
SB-2			1		1	1	1					
SB-3									2			
SB-4									2			
SB-5												
SB-6			2		2	2	2					
SB-7 to SB-15***	North Parcel - Soil Piles		1		1	1	1					
SB-16	Adjacent to AOC-B (UST) and Huntingdon Ave.	AOC-B	4		4	4	4					
MW-119	Down-gradient of AOC-C (Dry Chemical Silos), Adjacent to East Aurora Street	AOC-B, AOC-C	1	1			1			Confirm or Deny Release	100	
SB-17	Adjacent to AOC-F (6,000 gal. UST)	AOC-F	2	2	2							
SB-18			1				1				Confirm or Deny Release	100
SB-50	Huntingdon Ave. Building, Pilot Plant, QA/QC Labs, Small Packaging Area, Satellite Hazardous Waste Container Storage Area	AOC-D1	1		1	1	1					
SB-51			1		1	1	1			Confirm or Deny Release		
SB-52			2		2	2	2					
SB-19	Huntingdon Ave. Building, Main mixing area	AOC-D2	1		1	1	1					
SB-20			1		1	1	1					
SB-21			1		1	1	1					
Chip Sampling***			4		4	4	4					
SB-22	Huntingdon Ave. Building, Spent copper etchant recycling area	AOC-E	2		2	2	2					
SB-23			1		1	1	1			Confirm or Deny Release	100	
SB-24	Adjacent to AOC-E 1 (Sample House/Former WWTS)	AOC-D, AOC-E	2		2	2	2			Confirm or Deny Release	100	
SB-25	Huntingdon Ave. Building, AOC-E	AOC-E							2			
SB-26			1		1	1	1					
SB-27			1		1	1	1					
SB-28									2			
SB-29			1		1	1	1					
SB-30			2		2	2	2					
SB-31			1		1	1	1					
SB-32			2		2	2	2					
SB-33			1		1	1	1					
SB-34			1		1	1	1					
SB-35			2		2	2	2					
SB-36			1		1	1	1					
MW-122			2		2	2	2					
MW-123			1		1	1	1					
MW-124			2		2	2	2					
MW-125			1		1	1	1					
MW-126	East Aurora Street Warehouse		1		1	1	1					
MW-127		1		1	1	1			Confirm or Deny Release	100		
SB-37	AOC-H (Former Flammable Material Rack Storage Area)	AOC-H	1		1		1					
SB-38			1		1		1			Confirm or Deny Release	100	
MW-129	Downgradient of AOC-J	AOC-J	2		2	2	2			Residual after closure.	100	
SB-39	Adjacent to AOC-L, West	AOC-L	1		1	1	1	1				
SB-40	Adjacent to AOC-L, East		1		1	1	1	1		Confirm or Deny Release	100	
SB-41	Gear Street building, Ink manufacturing area	AOC-K5	1	1	1	1						
SB-42			1	1	1	1				Confirm or Deny Release	100	
SB-43	Gear Street building, Chemical storage area	AOC-K8	2		2	2	2					
SB-44			1		1	1	1					
Chip Sampling***			4		4	4	4			Confirm or Deny Release	100	
SB-45	Gear Street building, Electroless Nickel Area	AOC-K6	2		2	2	2					
SB-46			1		1	1	1			Confirm or Deny Release	100	
SB-47	Gear Street building, Hazardous waste storage areas	AOC-I/K7	1		1	1	1					
SB-48/MW-128			2		2	1	2	2				
SB-49			1		1	1	1			Confirm or Deny Release	100	
Totals			74	5	71	68	70	4	8		100.0	

Notes:

Sample IDs in bold indicate proposed sample locations.

* Detections of metals via Method 6010 and or 7470 will determine need to perform Synthetic Precipitate Leaching Procedure (SPLP). Metals tested include: Copper, Lead, Tin, Silver, Arsenic, Mercury, Cyanide, Barium, Cadmium, Nickel, Chromium, Zinc, Beryllium, Antimony, Selenium, Thallium, and Vanadium. For budget purposes, 50% of total metals analysis will also be analyzed via SPLP extraction.

** Waste characteristic analytical requirements are subject to requirements of disposal facility. For budget purposes analysis will include flashpoint, reactivity, ETPH, TCLP metals, PCBs (mass), VOCs (mass), and pH.

*** Number of samples taken/analyzed may vary depending on size of area and/or amount of material. For budget purposes assume 4 samples per area.

Trip blanks will be collected and analyzed at a rate of 1 sample per cooler per day. Trip blanks are analyzed via Method 8260 and are performed at no charge to the client.

Field duplicates and equipment blanks are both performed at a rate of 5 percent per matrix (i.e. groundwater, soil) per analytical method.

Table 2
Summary of Analytical Samples - Groundwater
MacDermid, Inc.
526 Huntingdon Avenue
Waterbury, Connecticut

Groundwater Samples

Sample ID	Location	AOCs Covered	COCs						Rationale	Percent Completeness Goals
			VOCs Method 8260	SVOCs Method 8270	Metals Method 6010/7470 *	Cyanide Method 9010	ETPH CTETPH	PCBs Method 8082		
MW-101	North Parcel - Upgradient	AOC-A	1		1	1	1		Characterize Material and Volume of Material	100
MW-102	North Parcel - Downgradient		1		1	1	1			
MW-103	North of AOC-C	AOC-B	1		1		1	1	Confirm or Deny Release	100
MW-119	Downgradient of AOC-C, Adjacent to East Aurora Street	AOC-B, AOC-C	1	1	1	1			Confirm or Deny Release	100
MW-104	Downgradient of AOC-F	AOC-F	1			1	1		Confirm or Deny Release	100
MW-105			1			1	1			
MW-120	Huntingdon Ave. Building, Main mixing area	AOC-D2	1	1	1	1			Confirm or Deny Release	100
MW-121	Adjacent to AOC-E (Sample House)	AOC-D, AOC-E	1	1	1	1			Confirm or Deny Release	100
MW-110	Downgradient AOC-E (Sample House)		1	1	1	1				
MW-109	Huntingdon Ave. Building, AOC-E	AOC-E	1	1	1	1			1. Confirm or Deny Release. 2. Delineate Extent of Former Lagoon.	90
MW-107			1	1	1	1				
MW-108			1	1	1	1				
MW-122			1		1	1	1			
MW-123			1		1	1	1			
MW-124			1		1	1	1			
MW-125			1		1	1	1			
MW-126	AOC-G adjacent to East Aurora Street	AOC-G	1	1	1	1			1. Residual after closure. 2. Ambient Groundwater Quality.	90
MW-127	AOC-G adjacent to East Aurora Street		1	1	1	1				
MW-111	East of AOC-G (Former Finished Product Storage Area)		1	1	1	1				
MW-114	East of AOC-G (Former Finished Product Storage Area), adjacent to East Aurora Street		1	1	1	1				
MW-115	Corner between Former Finished Product Storage Area and Former Rack Storage Area		1	1	1	1				
MW-115D	Corner between Former Finished Product Storage Area and Former Rack Storage Area	AOC-G, Site wide	1	1	1	1			Ambient Groundwater Quality	
MW-117S	Adjacent to Gear Street, West of AOC-H; Shallow	AOC-H, Site wide	1	1	1	1			Ambient Groundwater Quality, Up-gradient (Adjacent to Residential Area)	90
MW-117D	Adjacent to Gear Street, West of AOC-H; Deep		1	1	1	1				
MW-116S	Adjacent to Gear Street, West of AOC-H; Shallow		1	1	1	1				
MW-116D	Adjacent to Gear Street, West of AOC-H; Deep		1	1	1	1				
MW-118S	Adjacent to Gear Street, Southwest of AOC-H; Shallow		1	1	1	1				
MW-118D	Adjacent to Gear Street, Southwest of AOC-H; Deep		1	1	1	1				
MW-112	Upgradient of AOC-K/ AOC-I		1	1	1	1				
SB-48/MW-128	Adjacent to AOC-I (Downgradient)	AOC-I	1	1	1	1			Residual after closure.	100
MW-129	Downgradient of AOC-J	AOC-J	1	1	1	1	1		Residual after closure.	100
MW-113	Corner of East Aurora Street and Gear Street	AOC-K	1	1	1	1			1. Residual after closure. 2. Ambient Groundwater Quality.	100
MW-130	Downgradient to AOC-L	AOC-L, Site wide	1		1	1		1	Confirm or Deny Release	
Totals			33	23	31	32	10	2		97.5

Notes:

Sample IDs in bold indicate proposed sample locations.

Metals for groundwater will be analyzed for target analyte list (TAL) which include Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Ti, V, Zn.

Trip blanks will be collected and analyzed at a rate of 1 sample per cooler per day. Trip blanks are analyzed via Method 8260 and are performed at no charge to the client.

Field duplicates and equipment blanks are both performed at a rate of 5 percent per matrix (i.e. groundwater, soil) per analytical method.

**Table 3
Conceptual Site Model
MacDermid, Inc.
526 Huntingdon Avenue
Waterbury, Connecticut**

Areas of Concern	Description of AOC	Source	Release Mechanism	Sampling Objectives	# of Borings Proposed	# of Wells Existing/Proposed	Matrix	Contaminants of Concern
AOC-A	North Parcel	Soil and/or sludge materials from former waste lagoons	Transport of lagoon sludge and/or contaminated soil to consolidation area	Assess the effectiveness of the current GW monitoring system	SB-1, SB-2, SB-5, SB-6	MW-101, MW-102	Groundwater	TAL Metals, VOCs, Cyanide, TIN, ETPH
				Assess the amount of material stored under cap			Soil	VOCs, RSR -15 Metals, Cyanide, Tin, ETPH (all) Waste Characterization (SB-3 & SB-4)
	Soil Disposal Area	Unknown	Potentially contaminated soil exposed to the environment	Assess type of material stored under cap	SB-3 & SB-4		Soil	VOCs, RSR -15 Metals, Cyanide, Tin, ETPH
AOC-B	Underground Storage Tank	Tank contents (No. 2 fuel)	Storage tank failure resulting in direct release to the environment	Assess if there has been a failure from the tank and a release to the surrounding environment	SB-16	MW-103	Soil	VOCs, ETPH
							Groundwater	VOCs, TAL Metals, ETPH, PCBs
AOC-C	Dry Chemical Silos	Chemical silo contents (i.e. sodium carbonate, sodium hydroxide, sodium metasilicate, anhydrous sodium hydroxide)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through concrete floor	Assess if a release has occurred	MW-119	MW-119	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin, monitor pH
							Soil	VOCs, RSR -15 Metals, Cyanide, Tin, ETPH
AOC-D1 and D2	Pilot Plant (AOC-D1)	Chemicals used during operation (i.e. copper etchant, solder stripper, inks, electroless nickel plating solution, dry batch chemicals)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through concrete floor	Establish if there has been a release through the concrete floor	SB-19, SB-20, SB-21, SB-50, SB-51, SB-52, Chip Sampling	MW-120	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin
	Main Mixing Area (AOC-D2)						Soil	VOCs, RSR -15 Metals, Cyanide, Tin, ETPH
AOC-E1	Former Waste Lagoons and LNAPL	Former contents of lagoons (i.e. metal hydroxide, metals, cyanide, and industrial solvents)	Percolation of unlined lagoon contents into underlying soils	Assess if there is any residual waste in the buried lagoons. Estimate horizontal and vertical extent of residual waste in the buried lagoons. Assess the degree and extent of LNAPL in MW-108.	SB-22, SB-23, SB-24 SB-25, SB-26, SB-27, SB-28, SB-29, SB-30, SB-31, SB-32, SB-33, SB-34, SB-35, SB-36, MW-122, MW-123, MW-124, MW-125	MW-107, MW-108, MW-109, MW-110, MW-121, MW-122, MW-123, MW-124, MW-125	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin (MW-107, MW-108, MW-109, MW-110, MW-121) VOCs, TAL Metals, Cyanide, Tin, ETPH (MW-122, MW-123, MW-124, MW-125)
AOC-E2	Wastewater Treatment System (WWTS)	Former contents of lagoons (i.e. metal hydroxide, metals, and industrial solvents)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through concrete floor				Soil	VOCs, RSR -15 Metals, Cyanide, Tin, ETPH (18) Waste Characterization (SB-28)
AOC-E3	Spent Copper Etchant Storage Area	Process chemicals (i.e. ammonia, arsenic, chloride, copper chromium, lead, nickel, tin, and zinc)	Spillage during handling operations and failure of storage tank resulting in migration of stored chemicals through concrete floor					
AOC-E4	Spent Copper Etchant Recycling Area	Process chemicals (i.e. ammonia, arsenic, chloride, copper chromium, lead, nickel, tin, and zinc)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through concrete floor					
AOC-E5	Acid Tank Farm	Bulk acid storage (i.e. hydrochloric acid, nitric acid, hydrogen peroxide, and sulfuric acid)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through concrete floor					
AOC-E6	1994 Spent Copper Etchant Spill	Process chemicals (i.e. ammonia, arsenic, chloride, copper chromium, lead, nickel, tin, and zinc)	Documented release of contents to Steele Brook via the stormwater collection system					
AOC-F	Former 6,000 Gallon UST (East Aurora Street Building)	Tank contents (No. 2 fuel)	Storage tank failure resulting in direct release to the environment	Determine if there has been a release from the UST	SB-17, SB-18	MW-104, MW-105	Groundwater	VOCs, TAL Metals, Cyanide, Tin, ETPH
							Soil	VOCs, ETPH

**Table 3
Conceptual Site Model
MacDermid, Inc.
526 Huntingdon Avenue
Waterbury, Connecticut**

Areas of Concern	Description of AOC	Source	Release Mechanism	Sampling Objectives	# of Borings Proposed	# of Wells Existing/Proposed	Matrix	Contaminants of Concern
AOC-G	East Aurora Street Warehouse	Process chemicals (i.e. ammonia, arsenic, chloride, copper chromium, lead, nickel, tin, and zinc)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through concrete floor	Assess if there has been a release to the groundwater		MW-111, MW-114, MW-115, MW-115D, MW-126, MW-127	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin
AOC-H	Flammable Material Rack Storage Area	Process chemicals (i.e. alcohols, toluene, xylene, additional solvents)	Spillage during handling operations and failure of storage tank resulting in direct release to the environment	Determine if there has been a release in the Flammable Material Rack Storage Area	SB-37 SB-38	MW-112, MW-116S, MW-116D, MW-117S, MW-117D, MW-118S, MW-118D	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin
							Soil	VOCs, RSR -15 Metals, Tin, ETPH
AOC-I	Ink Spill Area	Epoxy-like ink material (contents aromatic ketones, acrylic monomers, metals)	Documented release migrating through concrete pad	Assess if the groundwater has been impacted from the Ink spill		MW-128	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin
AOC-J	4,000 Gallon UST (Gear Street Building)	Tank contents (No.2 fuel)	Storage tank failure resulting in direct release to the environment	Assess if the groundwater in the area of the UST has been impacted	MW-129	MW-129	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin, ETPH
							Soil	VOCs, RSR -15 Metals, Tin, Cyanide, ETPH
AOC-K1	Former Flammable Storage Area	Process chemicals (i.e. ethyl ketone, toluene, xylene, additional solvents)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through concrete floor	Assess if the groundwater in the area has been impacted		MW-113	Groundwater	VOCs, SVOCs, TAL Metals, Cyanide, Tin
AOC-K2	Former NMP Recycling Area		Spillage during handling operations and failure of storage tank resulting in migration of stored chemicals through concrete floor					
AOC-K3	Former Solder Stripper Recycling Area	Process chemicals (i.e. tin, lead, zinc, and copper)	Spillage during handling operations and failure of storage tank resulting in migration of stored chemicals through concrete floor					
AOC-K4	Gear Street Industrial Wastewater Sump Release	Industrial wastewater	Documented release resulting in migration through concrete floors					
AOC-K5	Ink Manufacturing Area	Process ink (i.e. pigments, solvents, acrylamides, and resins)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through secondary containment and concrete floor	Determine if there has been a release in the Ink Manufacturing Area	SB-41, SB-42		Soil	VOCs, SVOCs, RSR -15 Metals, Tin, Cyanide
AOC-K6	Electroless Nickel Area	Process chemicals (i.e. nickel compounds, sodium compounds, and phosphates)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through secondary containment and concrete floor	Determine if there has been a release to in the Electroless Nickel Area	SB-45, SB-46		Soil	VOCs, RSR -15 Metals, Tin, Cyanide, ETPH
AOC-K7	Satellite Storage Areas	Various hazardous wastes (i.e. solvent, metals, and acids)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through secondary containment and concrete floor	Determine if there has been a release in any of the three Satellite Storage Areas	SB-47, SB-48, SB-49		Soil	VOCs, RSR -15 Metals, Tin, Cyanide, ETPH
AOC-K8	Chemical Storage Area	Various chemical wastes (i.e. solvent, metals, and acids)	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through secondary containment and concrete floor	Determine if there has been a release in the Chemical Storage Areas	SB-43, SB-44, Chip Sampling		Soil	VOCs, RSR -15 Metals, Tin, Cyanide, ETPH
AOC-L	Transformer Vault	Transformer fluid and components	Spillage during handling operations and/or failure of storage tank resulting in migration of stored chemicals through secondary containment and concrete floor	Determine if there has been a release from the transformer	SB-39, SB-40	MW-130	Groundwater	VOCs, TAL Metals, Cyanide, Tin, ETPH, PCBs
				Determine if the groundwater has been impacted in the area of the Transformer Vault			Soil	VOCs, RSR -15 Metals, Tin, Cyanide, ETPH, PCBs

Table 4
Analytical Sensitivity and Project Criteria
MacDermid, Inc.
526 Huntingdon Avenue
Waterbury, Connecticut

Analyte		Test America Reporting Limit Soil (mg/kg)	Test America Method Detection Limit Soil (mg/kg)	Test America Reporting Limit Groundwater (ug/L)	Test America Method Detection Limit Groundwater (ug/L)	Media							
						Soil			Soil Vapor		Groundwater		
SEMIVOLATILE ORGANIC COMPOUNDS		CAS Number				RES DEC (mg/kg)	V/C DEC (mg/kg)	GB PMC (mg/kg)	Proposed RES SVVC (ppm)	Proposed V/C SVVC (ppm)	SWPC (ug/L)	Proposed RES GWVC (ug/L)	Proposed V/C GWVC (ug/L)
Acenaphthene	83-32-9	0.33	0.058	10	0.346	1,000	2,500	84	NE	NE	SS-6.1	NE	NE
Acenaphthylene	208-96-8	0.33	0.063	10	0.345	1,000	2,500	84	NE	NE	0.3	NE	NE
Acenaphthylene	208-96-8		SIM:	0.1							0.3		
Aniline	62-53-3	0.33	0.032	10	0.423	107	NE	1.2	NE	NE	NE	NE	NE
Anthracene	120-12-7	0.33	0.053	10	0.322	1,000	2,500	400	NE	NE	1,100,000	NE	NE
Benzo(a)anthracene	56-55-3	0.33	0.048	10	0.441	1	7.8	1	NE	NE	0.3	NE	NE
Benzo(a)anthracene	56-55-3		SIM:	0.1							0.3		
Benzo(a)pyrene	50-32-8	0.33	0.042	10	0.318	1	1	1	NE	NE	0.3	NE	NE
Benzo(a)pyrene	50-32-8		SIM:	0.1							0.3		
Benzo(b)fluoranthene	205-99-2	0.33	0.056	10	0.448	1	7.8	1	NE	NE	0.3	NE	NE
Benzo(b)fluoranthene	205-99-2		SIM:	0.1							0.3		
Benzo(g,h,i)perylene	191-24-2	0.33	0.064	10	0.399	1,000	2,500	42	NE	NE	SS-4.92	NE	NE
Benzo(k)fluoranthene	207-08-9	0.33	0.054	10	0.293	8.4	78	1	NE	NE	0.3	NE	NE
Benzo(k)fluoranthene	207-08-9		SIM:	0.1							0.3		
Benzoic Acid	65-85-0	1.6	0.16	50	0.939	1,000	2,500	10,000	NE	NE	NE	NE	NE
Bis(2-chloroethyl)ether	111-44-4	0.33	0.16	10	1.991	1	5.2	2.4	NE	NE	42	NE	NE
Bis(2-chloroisopropyl)ether	108-60-1	0.33	0.053	10	0.538	8.8	82	2.4	NE	NE	3,400,000	NE	NE
Bis(2-ethyl hexyl)phthalate	117-81-7	0.33	0.042	10	1.682	44	410	11	NE	NE	59	NE	NE
Bis(2-ethyl hexyl)phthalate	117-81-7		SIM:	0.1							59		
4-Bromophenyl-phenylether	101-55-3	0.33	0.053	10	0.257	500	1,000	82	NE	NE	NE	NE	NE
Butyl benzyl phthalate	85-68-7	0.33	0.046	10	0.433	1,000	2,500	200	NE	NE	NE	NE	NE
4-Chloroaniline	106-47-8	0.33	0.044	10	0.305	270	2,500	5.6	NE	NE	NE	NE	NE
2-Chloronaphthalene	91-58-7	0.33	0.058	10	0.461	1,000	2,500	110	NE	NE	NE	NE	NE
2-Chlorophenol	95-57-8	0.33	0.071	10	0.46	339	2,500	7	NE	NE	NE	NE	NE
4-Chlorophenyl-phenylether	7005-72-3	0.33	0.065	10	0.483	500	1,000	82	NE	NE	NE	NE	NE
Chrysene	218-01-9	0.33	0.058	10	0.397	84	780	1#	NE	NE	SS-4.92	NE	NE
Chrysene	218-01-9		SIM:	0.1							SS-4.92		
Dibenzo(a,h)anthracene	53-70-3	0.33	0.05	10	0.385	1#	1#	1#	NE	NE	SS-0.01	NE	NE
Dibenzo(a,h)anthracene	53-70-3		SIM:	0.1							SS-0.01		
Dibenzofuran	132-64-9	0.33	0.058	10	0.462	270	2,500	5.6	NE	NE	NE	NE	NE
1,2-Dichlorobenzene	95-50-1	0.33	0.052	10	0.432	500	1,000	3.1	9.2	95	170,000	5,100	50,000
1,3-Dichlorobenzene	541-73-1	0.33	0.053	10	0.485	500	1,000	120	9.2	95	26,000	4,300	50,000
1,4-Dichlorobenzene	106-46-7	0.33	0.052	10	0.375	26	240	15	3	5.5	26,000	1,400	3,400
3,3-Dichlorobenzidene	91-94-1	0.66	0.037	10	0.602	1.4	13	0.33#	NE	NE	NE	NE	NE
2,4-Dichlorophenol	120-83-2	0.33	0.068	10	3	203	NE	4.2	NE	NE	15,800	NE	NE
Diethyl phthalate	84-66-2	0.33	0.082	10	0.37	1,000	1,000	1,100	NE	NE	NE	NE	NE
Dimethyl phthalate	131-11-3	0.33	0.058	10	0.294	1,000	1,000	1,100	NE	NE	NE	NE	NE
2,4-Dimethylphenol	105-67-9	0.33	0.044	10	0.63	1,000	2,500	28	NE	NE	NE	NE	NE
Di-n-butyl phthalate	84-74-2	0.33	0.051	10	1.874	1,000	2,500	140	NE	NE	120,000	NE	NE
Di-n-octyl phthalate	117-84-0	0.33	0.052	10	0.348	1,000	2,500	20	NE	NE	NE	NE	NE
2,4-Dinitrophenol	51-28-5	1.6	0.22	50	1.65	140	2,500	2.8	NE	NE	NE	NE	NE
2,4-Dinitrotoluene	121-14-2	0.33	0.05	10	0.478	140	2,500	2.8	NE	NE	NE	NE	NE
2,6-Dinitrotoluene	606-20-2	0.33	0.13	10	0.493	68	2,000	1.4	NE	NE	NE	NE	NE
Fluoranthene	206-44-0	0.33	0.055	10	0.513	1,000	2,500	56	NE	NE	3,700	NE	NE
Fluorene	86-73-7	0.33	0.056	10	0.347	1,000	2,500	56	NE	NE	140,000	NE	NE
Hexachlorobenzene	118-74-1	0.33	0.057	10	0.348	1	3.6	1	NE	NE	0.077	NE	NE
Hexachlorobenzene	118-74-1		SIM:	0.1							0.077		
Hexachlorocyclopentadiene	77-47-4	0.33	0.047	10	1.253	470	2,500	9.8	NE	NE	NE	NE	NE
Hexachloroethane	67-72-1	0.33	0.057	10	0.64	44	410	1	NE	NE	89	NE	NE
Hexachloroethane	67-72-1		SIM:	0.1							89		
Indeno(1,2,3-cd)pyrene	193-39-5	0.33	0.058	10	0.511	1	7.8	1#	NE	NE	SS-0.49	NE	NE
Indeno(1,2,3-cd)pyrene	193-39-5		SIM:	0.1							SS-0.49		
Isophorone	78-59-1	0.33	0.068	10	0.539	640	2,500	7.4	NE	NE	NE	NE	NE
2-Methylnaphthalene	91-57-6	0.33	0.06	10	0.492	474	2,500	9.8	NE	NE	NE	NE	NE
2-Methylphenol (o-Cresol)	95-48-7	0.33	N/A	10	0.503	1,000	2,500	70	NE	NE	NE	NE	NE
3-Methylphenol (m-Cresol)	108-39-4	N/A	N/A	N/A	N/A	1,000	2,500	70	NE	NE	NE	NE	NE
3-Methylphenol/4-Methylphenol (m&p-Cresol)	106-44-5	0.33	0.049	10	0.389	340	2,500	7	NE	NE	NE	NE	NE

Table 4
Analytical Sensitivity and Project Criteria
MacDermid, Inc.
526 Huntingdon Avenue
Waterbury, Connecticut

Analyte		Test America Reporting Limit Soil (mg/kg)	Test America Method Detection Limit Soil (mg/kg)	Test America Reporting Limit Groundwater (ug/L)	Test America Method Detection Limit Groundwater (ug/L)	Media							
						Soil			Soil Vapor		Groundwater		
SEMIVOLATILE ORGANIC COMPOUNDS	CAS Number					RES DEC (mg/kg)	I/C DEC (mg/kg)	GB PMC (mg/kg)	Proposed RES SVVC (ppm)	Proposed I/C SVVC (ppm)	SWPC (ug/L)	Proposed RES GWVC (ug/L)	Proposed I/C GWVC (ug/L)
Naphthalene	91-20-3	0.33	0.05	10	0.465	1,000	2,500	56	NE	NE	SS-24	NE	NE
2-Nitroaniline	88-74-4	1.6	0.044	50	0.448	4.1	1,200	1.65#	NE	NE	NE	NE	NE
3-Nitroaniline	99-09-2	1.6	0.047	50	0.407	200	2,500	4.2	NE	NE	NE	NE	NE
4-Nitroaniline	100-01-6	0.66	0.05	20	0.503	200	2,500	4.2	NE	NE	NE	NE	NE
Nitrobenzene	98-95-3	0.33	0.061	10	0.498	34	1,000	1#	NE	NE	NE	NE	NE
2-Nitrophenol	88-75-5	0.33	0.071	10	0.501	540	2,500	11	NE	NE	NE	NE	NE
n-Nitrosodi-n-propylamine	621-64-7	0.33	0.074	10	0.586	1#	1#	1#	NE	NE	NE	NE	NE
n-Nitrosodiphenylamine	86-30-6	0.33	0.059	10	0.414	130	1,200	1.4	NE	NE	NE	NE	NE
Pentachloronitrobenzene	82-68-8	0.33	0.059	10	0.57	2.4	NE	0.1	NE	NE	NE	NE	NE
Pentachlorophenol	87-86-5	1.6	0.023	50	4.113	5.1	48	1	NE	NE	NE	NE	NE
Pentachlorophenol	87-86-5		SIM:	1.25							NE		
Phenanthrene	85-01-8	0.33	0.054	10	0.284	1,000	2,500	40	NE	NE	0.077	NE	NE
Phenanthrene	85-01-8		SIM:	0.1							0.077		
Phenol	108-95-2	0.33	0.039	10	0.851	1,000	2,500	800	NE	NE	92,000,000	NE	NE
Pyrene	129-00-0	0.66	0.048	10	0.401	1,000	2,500	40	NE	NE	110,000	NE	NE
Pyridine	110-86-1	0.66	0.022	20	1.65	7	NE	0.14	NE	NE	NE	NE	NE
1,2,4,5-Tetrachlorobenzene	95-94-3	0.33	0.034	10	0.52	20	NE	0.4	NE	NE	NE	NE	NE
2,4,5-Trichlorophenol	95-95-4	1.6	0.05	50	0.33	1,000	2,500	140	NE	NE	NE	NE	NE
2,4,6-Trichlorophenol	88-06-2	0.33	0.048	10	0.42	56	520	1#	NE	NE	NE	NE	NE
Total Petroleum Hydrocarbons (using ETPH method)	-	12.00	0.77			500	2,500	2,500	NE	NE	NE	NE	NE
Total Petroleum Hydrocarbons (using SPLP-ETPH methods)	-	0.10	0.04	0.10	0.04	NE	NE	1 (mg/L)*	NE	NE	NE	NE	NE

NOTES
Substances and criteria listed in the Comprehensive List of Approved Additional Polluting Substances Criteria and Alternative Criteria (2005) are indicated by italicized text.
All criteria listed have been approved for statewide use unless preceded by the prefix "SS".
SS = If statewide criteria have not been established, but site specific criteria are available, this is denoted by the prefix "SS" and the most conservative site specific value are listed.
NE = Criteria has not been established
= Criteria based on detection limits
SIMS = selective ion monitoring. Detection limits are not reported as part of this methodology.
mol = million fibers per liter
mg/kg = milligrams per kilogram or pap
ug/L = micrograms per liter or ppb
mg/L = milligrams per liter or pap
ug/m³ = micrograms per cubic meter
ppb = parts per billion
pap = parts per million

Table 4
Analytical Sensitivity and Project Criteria
MacDermid, Inc.
526 Huntingdon Avenue
Waterbury, Connecticut

Analyte		Test America Reporting Limit Soil (mg/kg)	Test America Method Detection Limit Soil (mg/kg)	Test America Reporting Limit Groundwater (ug/L)	Test America Method Detection Limit Water (ug/L)	Media								
						Soil			Soil Vapor		Groundwater			
						RES DEC (mg/kg)	I/C DEC (mg/kg)	GB PMC (mg/kg)	Proposed RES SVVC (ppm)	Proposed I/C SVVC (ppm)	SWPC (ug/L)	Proposed RES GWVC (ug/L)	Proposed I/C GWVC (ug/L)	
VOLATILE ORGANIC COMPOUNDS	CAS Number													
Acetone	67-64-1	0.02	0.0023	5	0.49	500	1,000	140	57	290	NE	50,000	50,000	
Acetonitrile	75-05-8	0.05	0.013	5	0.92	500	NE	24	NE	NE	NE	NE	NE	
Acrolein	107-02-8	0.02	0.0058	10	0.57	10	NE	0.008	NE	NE	NE	NE	NE	
Acrylonitrile	107-13-1	0.005	0.0032	5	0.47	1.1	11	0.1	NE	NE	20	NE	NE	
Benzene	71-43-2	0.005	0.00071	0.5	0.05	21	200	0.2	0.78	1.4	710	130	310	
Bromodichloromethane	75-27-4	0.005	0.00065	1	0.2	9.9	92	0.11	0.0038	0.095	NE	2.3	73	
Bromoform	75-25-2	0.005	0.0017	1	0.06	78	720	0.8	0.04	0.98	10,800	75	2,300	
Bromomethane	74-83-9	0.005	0.0015	3	0.41	95	1,000	2	NE	NE	NE	NE	NE	
2-Butanone (MEK)	78-93-3	0.01	0.0034	2	0.31	500	1,000	80	130	230	SS-756,000	50,000	50,000	
n-Butylbenzene	104-51-8	0.005	0.001	1	0.07	500	1,000	14	10	100	SS-710	1,500	21,000	
sec-Butylbenzene	135-98-8	0.005	0.0012	1	0.03	500	1,000	14	10	100	SS-710	1,500	20,000	
t-Butylbenzene	98-06-6	0.005	0.00061	1	0.06	500	1,000	14	NE	NE	SS-710	NE	NE	
Carbon disulfide	75-15-0	0.005	0.00053	1	0.05	500	1,000	140	NE	NE	NE	NE	NE	
Carbon tetrachloride	56-23-5	0.005	0.00071	1	0.05	4.7	44	1	0.06	0.12	132	5.3	14	
Chlorobenzene	108-90-7	0.005	0.00088	1	0.04	500	1,000	20	6.1	60	420,000	1,800	23,000	
Chloroethane	75-00-3	0.005	0.0013	3	0.38	SS-210	NE	NE	140	260	SS-2,538	12,000	29,000	
Chloroform	67-66-3	0.005	0.00053	1	0.11	100	940	1.2	0.078	0.14	14100	26	62	
Chloromethane	74-87-3	0.005	0.001	1	0.16	47	440	0.54	5.1	53	NE	390	5,500	
2-Chlorotoluene	95-49-8	0.005	0.00084	1	0.08	500	1,000	2	NE	NE	NE	NE	NE	
4-Chlorotoluene	106-43-4	0.005	0.0011	1	0.07	500	1,000	2	NE	NE	NE	NE	NE	
Cyclohexane	110-82-7	0.005	0.0011	1	0.07	NE	SS-1,000	SS-400	NE	NE	NE	NE	NE	
Dibromochloromethane	124-48-1	0.005	0.0011	1	0.04	7.3	68	0.1	NE	NE	1020	NE	NE	
1,2-Dibromo-3-chloropropane	96-12-8	0.01	0.0016	1	0.16	0.44	4.1	NE	NE	NE	NE	NE	NE	
1,2-Dichlorobenzene	95-50-1	0.005	0.0011	1	0.08	500	1,000	3.1	9.2	95	170,000	5,100	50,000	
1,3-Dichlorobenzene	541-73-1	0.005	0.0011	1	0.06	500	1,000	120	9.2	95	26,000	4,300	50,000	
1,4-Dichlorobenzene	106-46-7	0.005	0.0012	1	0.06	26	240	15	3	5.5	26,000	1,400	3,400	
1,4-Dichlorobutene	110-57-6	0.01	0.0017	2	0.32	SS-0.07	SS-0.62	SS-0.08	NE	NE	NE	NE	NE	
Dichlorodifluoromethane	75-71-8	0.005	0.0016	1	0.14	NE	NE	NE	14	140	NE	93	1,200	
1,1-Dichloroethane	75-34-3	0.005	0.00065	1	0.06	500	1,000	14	14	150	SS-2,538	3,000	41,000	
1,2-Dichloroethane	107-06-2	0.005	0.0011	1	0.05	6.7	63	0.2	0.013	0.11	2,970	6.5	68	
1,1-Dichloroethylene (1,1 Dichloroethene)	75-35-4	0.005	0.0079	1	0.05	1	9.5	1.4	1.9	7	96	190	920	
1,2-Dichloroethylene (1,2 Dichloroethene)	540-59-0	0.005	0.0018	2	0.18	NE	NE	NE	SS-1,590	NE	NE	NE	SS-7585	
cis-1,2-Dichloroethylene (cis-1,2-Dichloroethene)	156-59-2	0.005	0.00092	1	0.13	500	1,000	14	3.4	35	SS-31,860	830	11,000	
trans-1,2-Dichloroethylene (trans-1,2-Dichloroethene)	156-60-5	0.005	0.00096	2	0.09	500	1,000	20	7.1	70	NE	1,000	13,000	
1,2-Dichloropropane	78-87-5	0.005	0.00097	1	0.02	9	84	1	0.021	0.13	NE	7.4	58	
1,3-Dichloropropene	542-75-6	0.005	0.0017	1	0.05	3.4	32	0.1	0.035	0.89	34,000	11	360	
Dichlorotrifluoroethane	34077-87-7	N/A	N/A	N/A	N/A	NE	NE	NE	NE	NE	NE	SS-10	NE	
2,4-Dimethylphenol	105-67-9	SVOC	SVOC	SVOC	SVOC	1,000	2,500	28	NE	NE	NE	NE	NE	
1,4-Dioxane	123-91-1	0.4	0.062	15	3	SS-220	SS-1,000	NE	NE	NE	NE	NE	NE	
Ethanol	64-17-5	0.05	0.012	5	1.85	NE	NE	NE	NE	NE	NE	NE	NE	

Table 4
Analytical Sensitivity and Project Criteria
MacDermid, Inc.
526 Huntingdon Avenue
Waterbury, Connecticut

Analyte		Test America Reporting Limit Soil (mg/kg)	Test America Method Detection Limit Soil (mg/kg)	Test America Reporting Limit Groundwater (ug/L)	Test America Method Detection Limit Water (ug/L)	Media							
						Soil			Soil Vapor		Groundwater		
VOLATILE ORGANIC COMPOUNDS	CAS Number					RES DEC (mg/kg)	I/C DEC (mg/kg)	GB PMC (mg/kg)	Proposed RES SVVC (ppm)	Proposed I/C SVVC (ppm)	SWPC (ug/L)	Proposed RES GWVC (ug/L)	Proposed I/C GWVC (ug/L)
Ethyl acetate	141-78-6	0.05	0.0066	2	1.04	NE	NE	NE	NE	NE	NE	NE	NE
Ethylbenzene	100-41-4	0.005	0.00071	1	0.1	500	1,000	10.1	9.3	93	580,000	2,700	36,000
Ethylene dibromide (EDB)	106-93-4	0.005	0.0012	1	0.02	0.007	0.067	0.1	0.0005	0.007	NE	0.3	11
Hexachlorobutadiene	87-68-3	0.005	0.0018	1	0.08	NE	73	1#	NE	NE	NE	NE	NE
Isopropanol	67-63-0	0.005	0.0009	5	0.77	NE	NE	NE	NE	NE	NE	NE	NE
Isopropylbenzene (Cumene)	98-82-8	0.005	0.00075	1	0.04	500	1,000	132	19	34	NE	2,800	6,800
4-Isopropyltoluene (p-Cymene)	99-87-6	0.005	0.0011	1	0.03	500	1,000	41.8	9.3	94	NE	1,600	22,000
Methanol by method 8015	67-56-1	10	1	10,000	1000	NE	NE	NE	NE	NE	SS-7.6	NE	NE
Methylene chloride	75-09-2	0.02	0.0014	5	0.28	82	760	1	0.65	6.8	48,000	160	2,200
Methyl isobutyl ketone (MIBK)	108-10-1	0.005	0.00094	2	0.15	500	1,000	14	6.8	68	NE	13,000	50,000
Methyl tert butyl ether (MTBE) ⁽¹⁾	1634-04-4	0.005	0.00074	1	0.05	500	1,000	20	34	73	SS-710	21,000	50,000
Naphthalene	91-20-3	0.005	0.00059	1	0.02	1,000	2,500	56	NE	NE	SS-24	NE	NE
Nitrobenzene	98-95-3	0.03	0.0062	5	0.73	34	1,000	1#	NE	NE	NE	NE	NE
n-Propylbenzene	103-65-1	0.005	0.00074	1	0.06	500	1,000	14	NE	NE	NE	NE	NE
Styrene	100-42-5	0.005	0.0013	1	0.04	500	1,000	20	9.3	95	NE	3,100	42,000
Tert-butyl alcohol	75-65-0	0.02	0.011	3	0.82	NE	NE	NE	NE	NE	NE	NE	NE
1,1,1,2-Tetrachloroethane	630-20-6	0.005	0.00066	1	0.07	24	220	0.2	0.009	0.22	NE	2	64
1,1,2,2-Tetrachloroethane	79-34-5	0.005	0.001	1	0.07	3.1	29	0.1	0.0012	0.028	110	1.8	54
Tetrachloroethylene (PCE)	127-18-4	0.005	0.00074	1	0.05	12	110	1	0.56	1	88	340	810
Tetrahydrofuran	109-99-9	0.02	0.0029	3	0.29	SS-81	NE	NE	NE	NE	NE	SS-370	SS-5900
Toluene	108-88-3	0.005	0.00059	1	0.06	500	1,000	67	42	180	4,000,000	7,100	41,000
1,1,1-Trichloroethane	71-55-6	0.005	0.00073	1	0.13	500	1,000	40	70	130	62,000	6,500	16,000
1,1,2-Trichloroethane	79-00-5	0.005	0.00087	1	0.2	11	100	1	0.31	3.1	1,260	220	2,900
1,2,4-Trichlorobenzene	120-82-1	0.005	0.0013	1	0.06	680	2,500	14	NE	NE	NE	NE	NE
Trichloroethylene (TCE)	79-01-6	0.005	0.00099	1	0.05	56	520	1	0.14	0.26	2,340	27	67
Trichlorofluoromethane	75-69-4	0.005	0.00095	1	0.06	500	1,000	260	50	120	NE	1,300	4,200
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.005	0.00078	2	0.04	NE	NE	NE	SS-440	SS-1,100	NE	NE	SS-10
1,2,4-Trimethylbenzene	95-63-6	0.005	0.0014	1	0.04	500	1,000	70	1.4	15	SS-710	360	4,800
1,3,5-Trimethylbenzene	108-67-8	0.005	0.00096	1	0.05	500	1,000	70	1.4	15	SS-710	280	3,900
Vinyl acetate	108-05-4	0.01	0.00016	5	0.15	NE	NE	NE	NE	NE	NE	NE	NE
Vinyl chloride	75-01-4	0.005	0.0013	1	0.09	0.32	3	0.4	0.041	1	15,750	1.6	52
Xylenes	133-02-07	0.005	0.0024	2	0.08	500	1,000	19.5	38	160	SS-702	8,700	48,000

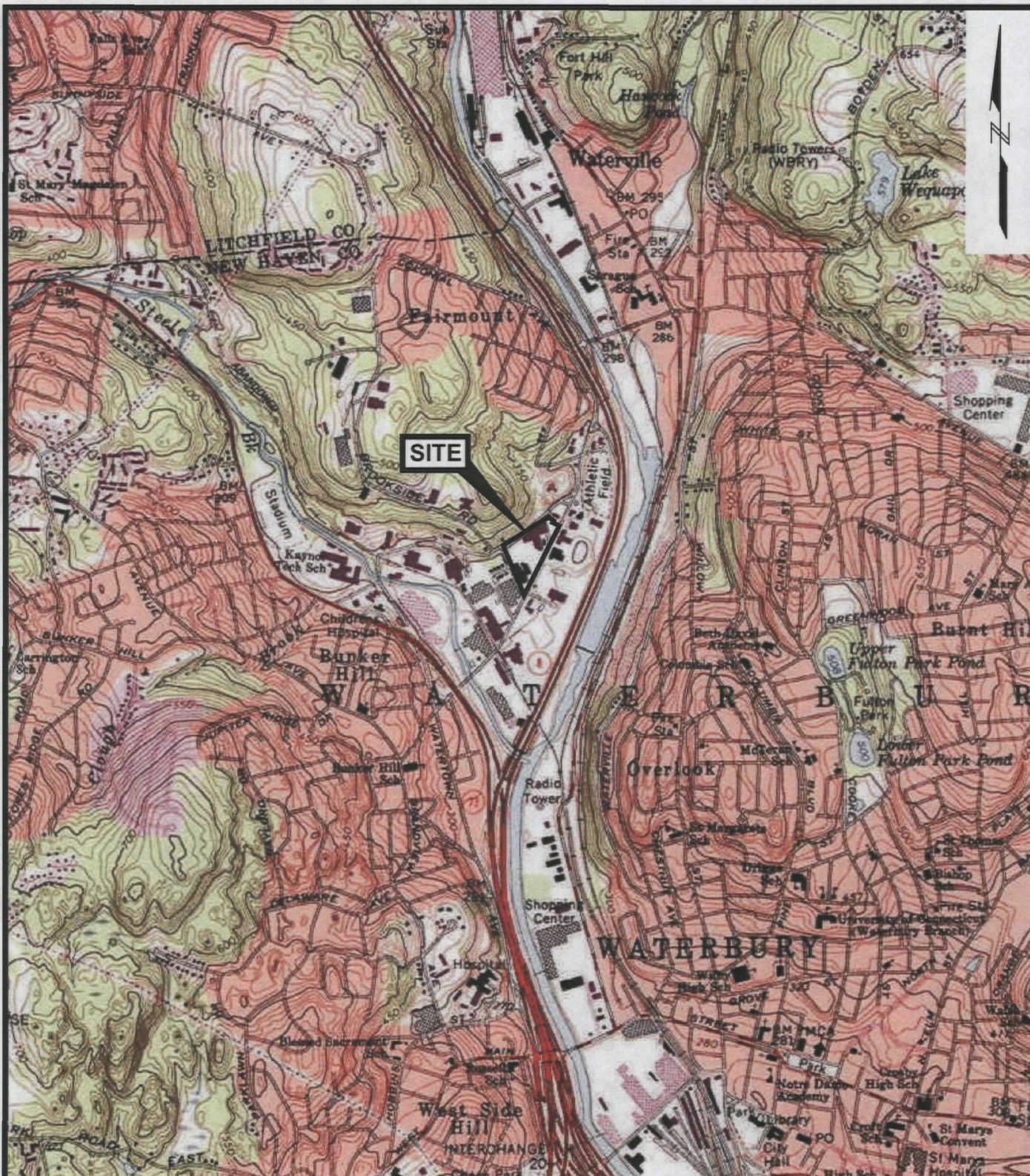
NOTES
Substances and criteria listed in the Comprehensive List of Approved Additional Polluting Substances Criteria and Alternative Criteria (2005) are indicated by italicized text.
All criteria listed have been approved for statewide use unless preceded by the prefix "SS".
SS = If statewide criteria have not been established, but site specific criteria are available, this is denoted by the prefix "SS" and the most conservative site specific value are listed.
NE = Criteria has not been established
= Criteria based on detection limits
⁽¹⁾ Codified criterion for MTBE GWPC is 100 ug/l, but the revised Drinking Water Action Level is 70 ug/l to be protective of human health.
mg/kg = milligrams per kilogram or ppm
ug/L = micrograms per liter or ppb
ppb = parts per billion
ppm = parts per million

Table 4
Analytical Sensitivity and Project Criteria
MacDermid, Inc.
526 Huntingdon Avenue
Waterbury, Connecticut

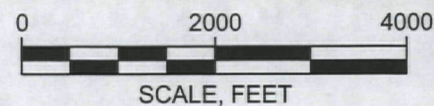
Analyte		Test America Reporting Limit Soil (mg/kg)	Test America Method Detection Limit Soil (mg/kg)	Test America Reporting Limit Groundwater (ug/L)	Test America Method Detection Limit Groundwater (ug/L)	Media					
						Soil			Groundwater		
INORGANIC SUBSTANCES	CAS Number					RES DEC (mg/kg)	I/C DEC (mg/kg)	GB PMC (mg/l)**	SWPC (ug/L)	RES GWVC (ug/L)	I/C GWVC (ug/L)
<i>Antimony</i>	7440-36-0	10	1.38	25	3	27	8,200	0.06	86,000	NE	NE
<i>Arsenic via Method 6020 ICP/MS</i>	7440-38-2	8	1.36	1	0.5	10	10	0.1 ⁽⁶⁾	4	NE	NE
<i>Barium</i>	7440-39-3	2	0.22	2.5	1.2	4,700	140,000	10	SS-4,540	NE	NE
<i>Beryllium</i>	7440-41-7	2	0.46	2.5	0.3	2	2	0.04	4	NE	NE
<i>Cadmium</i>	7440-43-9	5	0.92	5	0.55	34	1,000	0.05	6	NE	NE
<i>Chromium, total</i>	7440-47-3	3	0.34	5	0.95	NE	NE	0.5	NE	NE	NE
<i>Cobalt</i>	7440-48-4	2	0.52	5	1.05	70	NE	0.1	NE	NE	NE
<i>Copper</i>	7440-50-8	5	0.44	5	1.95	2,500	76,000	13	48	NE	NE
<i>Cyanide</i>	57-12-5	0.5	0.073	10	1.322	1,400	41,000	2*	52	NE	NE
<i>Lead</i>	7439-92-1	5	0.84	5	2.45	400 ⁽¹⁾	1,000	0.15	13	NE	NE
<i>Mercury</i>	7439-97-6	0.05	0.0127	0.2	0.1	20	610	0.02	0.4	NE	NE
<i>Nickel</i>	7440-02-0	5	0.44	5	0.95	1,400	7,500	1	880	NE	NE
<i>Selenium</i>	7782-49-2	10	1.64	15	4.9	340	10,000	0.5	50	NE	NE
<i>Silver</i>	7440-22-4	3	0.3	2.5	0.65	340	10,000	0.36	12	NE	NE
<i>Thallium</i>	7440-28-0	15	2.2	20	4.05	5.4	160	0.05	63	NE	NE
<i>Tin</i>	7440-31-5	15	1.66	75	7.5	SS-2,000	SS-2,000	NE	NE	NE	NE
<i>Vanadium</i>	7440-62-2	4	0.32	2.5	0.5	470	14,000	0.5	NE	NE	NE
<i>Zinc</i>	7440-66-6	20	2.2	25	6	20,000	610,000	50	123	NE	NE
<i>Polychlorinated Biphenyls</i>	1336-36-3	1	0.5	0.5	0.1	1	10	0.005 mg/l **	0.5	NE	NE

NOTES
Substances and criteria listed in the Comprehensive List of Approved Additional Polluting Substances Criteria and Alternative Criteria (2005) are indicated by italicized text.
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 SS = If statewide criteria have not been established, but site specific criteria are available, this is denoted by the prefix "SS" and the most conservative site specific value are listed.
 NE = Criteria has not been established
 ** = Criteria derived by SPLP or TCLP
 mg/kg = milligrams per kilogram or ppm
 ug/L = micrograms per liter or ppb
⁽¹⁾ Codified criterion for lead RDEC is 500 ppm, but the recommended cleanup criterion is 400 ppm to be protective of human health.
 ppb = parts per billion
 ppm = parts per million

Figures



SOURCE: Map created with TOPO!® ©2001 National Geographic
(www.nationalgeographic.com/topo)



MacDERMID, INC.
526 HUNTINGDON AVENUE
WATERBURY, CONNECTICUT

MacDERMID, INC.
WATERBURY, CONNECTICUT

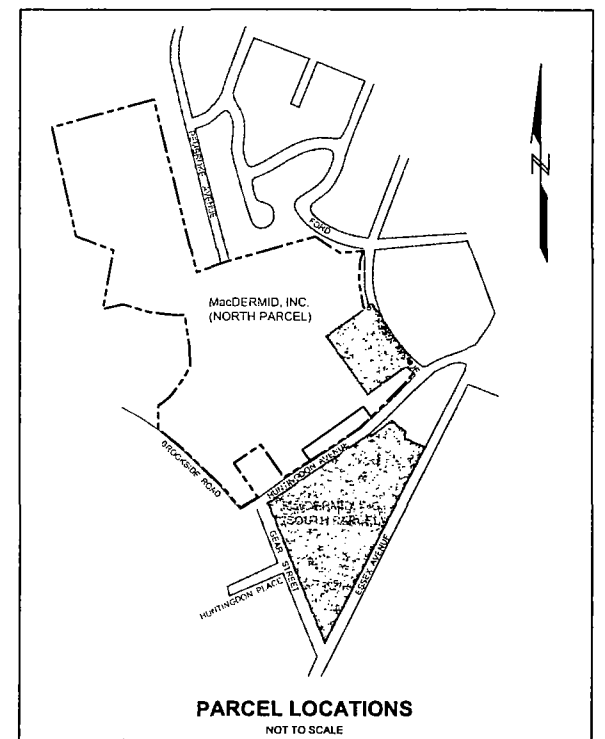
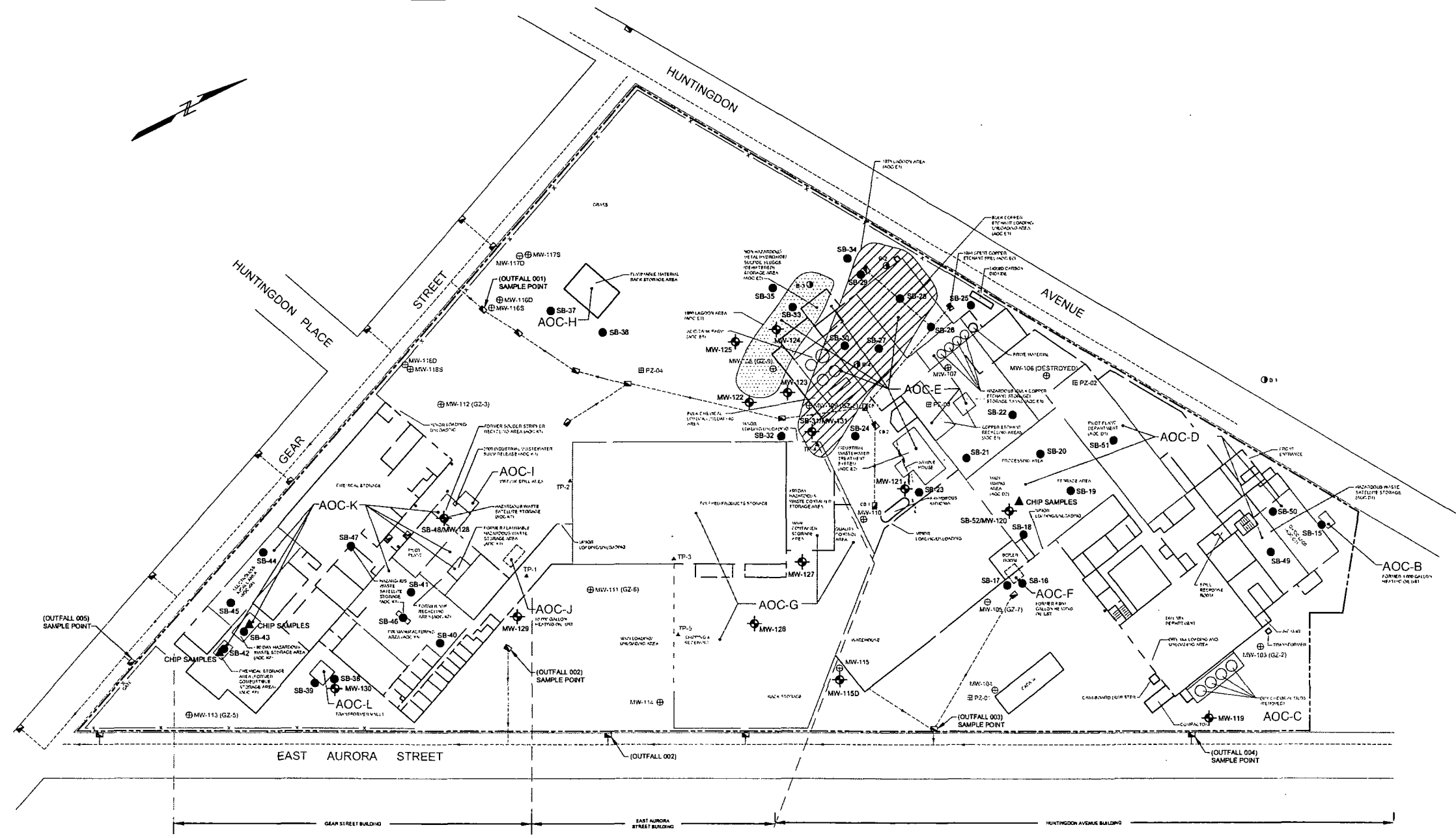


Project 073290-1000

SITE LOCATION MAP

April 2008

Figure 1



LEGEND

- MW-119 - PROPOSED MONITORING WELL
- SB-1 - PROPOSED SOIL BORING
- CHIP SAMPLES - PROPOSED CHIP SAMPLING LOCATION
- ⊕ - GROUNDWATER MONITORING WELL
- - - CATCH BASIN/STORM DRAIN
- - 1985 TEST BORING
- ▲ - 1985 SOIL TEST PIT (APPROXIMATE LOCATION)
- ▨ - 1975 LAGOON AREA (APPROXIMATE LOCATION), AOC-E1
- ▤ - 1980 LAGOON AREA (APPROXIMATE LOCATION), AOC-E1
- ⊞ - PIEZOMETER
- - POSSIBLE LOCATION OF SOIL PILE

SOURCE:
1. PLAN BASED ON MAP PREPARED BY HRP ASSOCIATES, INC., PLAINVILLE, CT
TITLED AREAS OF CONCERN (AOC) AND RSR EXCEEDANCES, MacDERMID,
INC., 526 HUNTINGDON AVENUE, WATERBURY, CONNECTICUT, DATED
FEBRUARY 2005.

MONITORING WELL	FORMER MONITORING WELL DESIGNATION	DATE OF INSTALLATION	TYPE OF WELL	SCREEN DEPTH	STATUS
MW-101	MAC-6	4/2/86	BEDROCK	28-38'	ACTIVE
MW-102	MAC-5	3/31/86	SHALLOW OVERBURDEN	22-32'	ACTIVE
MW-103	GZ-2	1/12/95	SHALLOW OVERBURDEN	25-35'	ACTIVE
MW-104	MAC-7	UNKNOWN	SHALLOW OVERBURDEN	UNKNOWN	INACTIVE (CLOGGED)
MW-105	GZ-7	2/15/95	SHALLOW OVERBURDEN	27-37'	ACTIVE
MW-106	MAC-4	UNKNOWN	SHALLOW OVERBURDEN	UNKNOWN	INACTIVE (LOST)
MW-107	MAC-3	UNKNOWN	SHALLOW OVERBURDEN	UNKNOWN	INACTIVE (CLOGGED)
MW-108	GZ-9	2/18/95	SHALLOW OVERBURDEN	25-35'	ACTIVE
MW-109	GZ-8	2/15/95	SHALLOW OVERBURDEN	25-35'	ACTIVE
MW-110	MAC-1	UNKNOWN	SHALLOW OVERBURDEN	UNKNOWN	ACTIVE
MW-111	GZ-6	1/13/95	SHALLOW OVERBURDEN	25-35'	ACTIVE
MW-112	GZ-3	1/13/95	SHALLOW OVERBURDEN	25-35'	ACTIVE
MW-113	GZ-5	1/13/95	SHALLOW OVERBURDEN	30-40'	ACTIVE

MacDERMID, INC.
526 HUNTINGDON AVENUE
WATERBURY, CONNECTICUT

MacDERMID, INC.
WATERBURY, CONNECTICUT

PROJECT 073290-1000

455 WINDING BROOK DRIVE
SUITE 201
GLASTONBURY, CONNECTICUT 06033

**SITE LAYOUT AND
PROPOSED SAMPLE LOCATIONS**

April 2008

Appendix A

GEI Standard Operating Procedures (SOPs) (electronic only)

Appendix B

TestAmerica Standard Operating Procedures (electronic only)

Appendix C

TestAmerica Chain of Custody (electronic only)

Appendix B

HASP



Geotechnical
Environmental and
Water Resources
Engineering

Health and Safety Plan (HASP)

MacDermid Incorporated

526 Huntington Avenue

Waterbury, Connecticut

USEPA ID# CTD001164599

Permit # DEP/HWM/CS-151-001

Submitted to:

Lawrence E. Miles, REM

Director of Environment, Health and Safety

MacDermid Incorporated

245 Freight Street

Waterbury, CT 06702

Submitted by:

GEI Consultants, Inc.

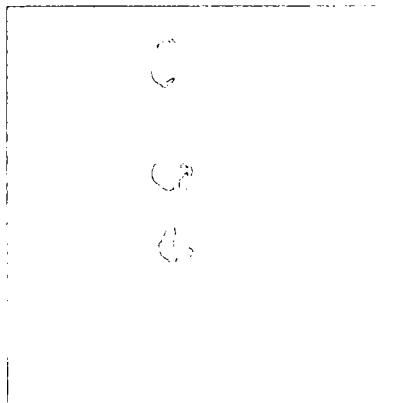
455 Winding Brook Drive, Suite 201

Glastonbury, CT 06033

860-368-5300

April 2008

Project # 073290-*-1000



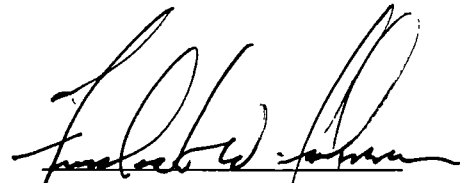

Frederick Johnson, LEP
Project Manager

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Abbreviations and Acronyms

AOC	Area of Concern
ASTM	American Society for Testing and Materials
BOD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CAMP	Community Air-Monitoring Plan
CERCLA	Comprehensive Environmental Response, Cleanup, and Liability Act
CFR	Code of Federal Regulations
COC	Chain of Custody
CHSO	Corporate Health and Safety Officer
DL	Detection Limit
DNAPL	Dense Non-Aqueous Phase Liquid
DO	Dissolved Oxygen
DQO	Data Quality Objectives
EC	Engineering Controls
EIS	Environmental Impact Study
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
FS	Feasibility Study
FWRIA	Fish and Wildlife Resources Impact Analysis
GAC	Granular Activated Carbon
GC/MS	Gas Chromatograph/Mass Spectrometer
GFAA	Graphite Furnace Atomic Absorption Spectrometry
GIS	Geographic Information Systems
GPR	Ground-penetrating Radar
HASP	Health and Safety Plan
HOC	Halogenated Organic Compound
HDPE	High Density Polyethylene
HPLC	High Pressure Liquid Chromatography
IC	Institutional Controls
ICP	Inductively Coupled Plasma Atomic Emission Spectrometry
LEL	Lower Explosive Limit
LNAPL	Light Non-Aqueous Phase Liquid
MCL	Maximum Contaminant Level (for EPA Drinking Water Stnds)
MDL	Method Detection Limit
MGP	Manufactured Gas Plant
MSDS	Material Safety Data Sheet
NAPL	Non-aqueous Phase Liquids
NCP	National Contingency Plan
NPL	National Priority List
OSHA	Occupational Safety and Health Administration

PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QHEA	Qualitative Human Exposure Assessment
RAO	Remedial Action Objectives
RAP	Remedial Action Plan
RCRA	Resource Conservation Recovery Act
RD	Remedial Design
RI	Remedial Investigation
RFP	Request For Proposal
RP	Responsible Party
SARA	Superfund Amendments and Reauthorization Act
SCGs	Standards, Criteria, and Guidance
SMP	Site Management Plan
SOP	Standard Operating Procedure
SOW	Scope of Work or Statement of Work
SPLP	Synthetic Precipitate Leaching Procedure
STEL	Short-Term Exposure Limit
SVE	Soil Vapor Extraction
SVOC	Semivolatile Organic Compounds
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compound from Mass Spectrometry
TOC	Total Organic Carbon
TOSCA	Toxic Substance Control Act
TPH	Total Petroleum Hydrocarbons
TWA	Time Weighted Average
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
USGS	United States Geologic Survey
VOC	Volatile Organic Compounds
WP	Work Plan
XREF	X-Ray Fluorescence

MEASUREMENTS

bgs	Below Ground Surface
msl	mean sea level
ppbv	Parts Per Billion by Volume
µg/L	Microgram per liter
µg/Kg	Microgram per kilogram
Mg/L	Milligram per Liter
Mg/Kg	Milligram per Kilogram
Mfl	Million fibers per liter

1. Health and Safety Plan

1.1 Background Information

1.2 General

Engineer	GEI Consultants, Inc. (GEI) 455 Winding Brook Drive, Suite 201 Glastonbury, CT 06033
Project Name	MacDermid Incorporated (MacDermid), 526 Huntingdon Avenue, Waterbury, CT

This Health and Safety Plan (HASP) establishes policies and procedures to protect GEI personnel from the potential hazards posed by the activities at the MacDermid, 526 Huntingdon Avenue, Waterbury, CT (Site). Reading of the HASP is required of all on-site GEI personnel and GEI subcontractors. The plan identifies measures to minimize accidents and injuries, which may result from project activities or during adverse weather conditions.

1.3 Project Description

The objective for this project is to further characterize and delineate documented Areas of Concern (AOCs). Characterization and delineation will be conducted on a per AOC basis with some sample points serving multiple purposes. Sampling matrices include soil, groundwater, and concrete. Field activities include the installation of soil borings, monitoring wells, and the collection of concrete chip samples.

1.4 Site Description

The site is owned by MacDermid and is located at 526 Huntingdon Avenue in Waterbury, Connecticut. The site consists of two parcels designated in this report as the South and North parcel. The south parcel is located on the southern side of Huntingdon Avenue and encompasses approximately 11 acres. The south parcel is improved with three interconnected buildings having a total footprint of approximately 182,500 square feet. These buildings are referred to as the Gear Street Building, East Aurora Street Building, and the Huntingdon Avenue Building. There is little topographic relief on this parcel which lies approximately 300 feet above mean sea level.

The site is located approximately 1,000 feet northwest of the Naugatuck River, which lies at approximately 260 feet above sea level. The site and immediate surroundings are zoned for industrial use.

The northern parcel is located on the northern side of Huntingdon Avenue, and encompasses approximately 30 acres. The investigation of the north parcel is limited to a paved area, located approximately 400 feet north of Huntingdon Avenue, which serves as an asphalt cap to a sludge and/or soil disposal area. The contents and characteristics of this material are to be determined during this investigation.

1.5 Hazard/Risk Analysis

Physical hazards associated with drilling and environmental sampling operations are present. The heavy equipment associated with this project will include drill rigs, truck-mounted rigs, and core machines. Some of the hazards associated with this equipment include crushing of limbs, slipping, tripping, or falling, and heavy lifting. In addition, subsurface investigation has the potential to damage utility lines, generate fugitive dust, and expose contaminated soil and/or groundwater. Finally, volatile organic compounds contained in sample matrices (groundwater, soil, or concrete) pose an inhalation hazard. As a precaution, ambient air will be continuously monitored using a Photoionization detector (PID). An activity hazard analysis is provided in Section 1.5.

Non-site specific hazards also exist and are discussed in this HASP. A potential risk to site workers posed by general environmental condition include heat stress (discussed in Section 1.6), cold stress (discussed in Section 1.7) and biological hazards (discussed in Section 1.8).

The Contractor should verify that all electric, gas, water, steam, sewer, and other services lines should be shut off, capped, or otherwise controlled, at or outside the building before demolition work is started. In each case, any utility company that is involved should be notified in advance by the Contractor, and its approval or services, if necessary, shall be obtained.

Smoking should be prohibited at or in the vicinity of hazardous operations or materials. Where smoking is permitted, safe receptacles shall be provided for smoking materials. The hazards for this operation are listed in the following Activity Hazard Analysis and Site Hazards sections.

1.6 Activity Hazard Analysis

▪ Activity: Subsurface Drilling

Task	Potential Hazard	Control Measure
1. Installation of Monitoring Wells	▪ Damaging utility lines	Mark out and clear all drilling locations with public utilities and owner.
	▪ Inhalation of volatilized organic compounds	Continuous monitoring using Photoionization detector (PID).
	▪ Loud Noise (Drill Rig)	Use hearing protection
	▪ Physical Injury from heavy machinery	<ul style="list-style-type: none"> ▪ Wear hard hat at all times while drilling and/or overhead operations are occurring. ▪ Wear work boots in good condition with non-slip soles. ▪ Maintain good visibility of the work area. ▪ Avoid walking on uneven or debris-ridden ground surfaces.
2. Installation of Subsurface Borings	▪ Damaging Utility Lines	Mark out and clear all drilling locations with public utilities and owner.
	▪ Inhalation of volatilized organic compounds	Continuous monitoring using Photoionization detector (PID).
	▪ Loud Noise (Drill Rig)	Use hearing protection
	▪ Physical Injury from heavy machinery	<ul style="list-style-type: none"> ▪ Wear hard hat at all times while drilling and/or overhead operations are occurring. ▪ Wear work boots in good condition with non-slip soles. ▪ Maintain good visibility of the work area. ▪ Avoid walking on uneven or debris-ridden ground surfaces.

▪ **Activity: Environmental Sampling**

Task	Potential Hazard	Control Measure
1. Soil Sampling	▪ Contaminant contact	Wear protective coveralls (e.g. Tyvek®) with shoe covers, nitrile gloves, safety glasses. Wear a P100 disposable respirator (if necessary). Dispose of gloves after use. Wash hands. Continuous monitoring of VOC concentrations in ambient air using a PID.
2. Groundwater Sampling	▪ Contaminant contact	Wear protective coveralls (e.g. Tyvek®) with shoe covers, nitrile gloves, safety glasses. Wear a P100 disposable respirator (if necessary). Dispose of gloves after use. Wash hands. Continuous monitoring of VOC concentrations in ambient air using a PID.
3. Concrete Chip Sampling	▪ Electrical Hand Tools (cutting concrete)	Ensure electrical equipment is connected to a Ground Fault Circuit Interrupter (GFCI).
	▪ Contaminant contact	Wear protective coveralls (e.g. Tyvek®) with shoe covers, nitrile gloves, safety glasses. Wear a P100 disposable respirator (if necessary). Dispose of gloves after use. Wash hands. Continuous monitoring of VOC concentrations in ambient air using a PID.
Protective Equipment: Protective leather or Kevlar gloves, coveralls (e.g. Tyvek®) with boot covers, safety glasses, face shield (when necessary), P100 disposable respirator (when necessary), steel toe boots, and nitrile (or latex) gloves.		

Potential Hazards	Control Measures
1. Inclement Weather	Weather reports, proper clothing, and work stoppage.
2. Heat/Cold Stress	Proper clothing, acclimatization, regular work breaks, fluid intake, watch for signs of heat/cold stress. See Attachment 1.
3. Biological Hazards	Protective coveralls (e.g. Tyvek®) with shoe covers, safety glasses, P100 disposable respirator (when necessary), Nitrile (or latex) gloves.
4. Chemical Exposure	Protective coveralls (e.g. Tyvek®) with shoe covers, safety glasses, face shield, P100 disposable respirator (when necessary), Nitrile (or latex) gloves.
5. Electrical Hazards	Ensure portable electrical equipment is equipped with a GFCI.
6. Slip/Trip/Fall	Keep trafficked areas free of slip/trip/fall hazards.
7. Heavy Lifting – Sprains & Strains	Use proper lifting techniques. Ask fellow worker for help.
8. Falling or handling debris – crushing, eye injury, head injury, splinters	Maintain awareness of operations and keep a safe distance away from structures as they are torn down; wear eye protection and hard hat; wear leather or Kevlar gloves.

General on site provisions shall include: extra nitrile, leather, latex, and/or Kevlar gloves, extra protective coveralls (e.g. Tyvek®) with boot covers, drinking water, P100 disposable respirators first aid kit, hearing protection and washing facilities.

1.7 Cold Stress Program

1.7.1 Purpose & Introduction

The purpose of this document is to educate the employee about exposure to cold environments and the effects of hypothermia and other cold-related injuries. Through proper use of Personal Protective Equipment (PPE), engineering and administrative controls, and education; cold injury, both to the extremities and the body's core temperature, can be prevented.

1.7.2 Scope

This program is intended for use by employees engaged in work with the potential for exposure to cold environments. This program will be reviewed annually by the Health and Safety Division. Training will be provided annually to all those potentially affected, and will include this written program.

1.7.3 Working In Cold Environments

1. Metabolic Responses

The human body is designed to function best at a rectal temperature of 99-100F.

The body maintains this temperature in two ways: by gaining heat from food and muscular work; or, by losing it through radiation and sweating. By constricting blood vessels of the skin and/or shivering, the body uses its first line of cold defense.

Temperature control of the body is better understood by dividing the body into two main parts: the shell; and, the core. The shell is comprised of the skin, capillaries, nerves, muscles and fat. Other internal organs such as the heart, lungs, brain and kidneys make up the core.

During exposure to cold, the skin is first affected. Blood in the peripheral capillaries is cooled, sending a signal to a portion of the brain called the hypothalamus. Regulating body temperature is one of the many basic body functions of the hypothalamus. Acting like a thermostat, adjustments are performed in order to maintain normal body temperatures. When a chill signal is received, two processes are begun by the hypothalamus: conserve heat already in the body; and, generate new heat.

Heat conservation is performed through constriction of the blood vessels in the skin (shell), thus reducing heat loss from the shell and acting as an insulator for the core. Sweat glands are also inhibited, thus preventing heat loss by evaporation.

Additional fuel for the body is provided in the form of glucose. Glucose causes the heart to beat faster, sending oxygen and glucose-rich blood to the tissue where needed. In an attempt to produce heat, the muscles rapidly contract. This process is better known as “shivering”, and generates heat similarly to that created by strenuous activity, raising the body’s metabolic rate.

During physical activity and fatigue, the body is more prone to heat loss. As exhaustion approaches, blood vessels can suddenly enlarge, resulting in rapid loss of heat. Exposure to extreme cold causes nerve pulses to be slowed, resulting in fumbling, sluggish and clumsy reactions.

1.7.4 Cold Injuries

Cold injuries are classified into two categories: local; or, general. Local injuries include frostbite, frostnip, chilblain and trenchfoot. General injuries include hypothermia and blood vessel abnormalities (genetically or chemically induced). Major factors contributing to cold injury are exposure to humidity and high winds; contact with wetness or metal; inadequate clothing; age; and, general health. Allergies, vascular disease, excessive smoking and/or drinking, and certain drugs and medicines are physical conditions that can compound the effects of exposure to a cold environment.

1. Hypothermia

Hypothermia is a condition of reduced body temperature. Most cases develop in air temperatures between 30-50°F, not taking wind-chill factor in consideration.

Symptoms of hypothermia are uncontrolled shivering and the sensation of cold. The heartbeat slows and sometimes becomes irregular, weakening the pulse and changing blood pressure. Changes in the body chemistry cause severe shaking or rigid muscles; vague or slow slurred speech; memory lapses; incoherence; and, drowsiness. Cool skin, slow irregular breathing, low blood pressure, apparent exhaustion, and fatigue after rest can be seen before complete collapse.

As the core temperature drops, the victim can become listless, confused, and make little or no effort to keep warm. Pain in the extremities can be the first warning of dangerous exposure to cold. Severe shivering must be taken as a sign of danger. At a core body temperature of about 85°F, serious problems develop due to significant drops in blood pressure, pulse rate and respiration. In some cases, the victim may die.

Sedative drugs and alcohol increase the risk of hypothermia. Sedative drugs interfere with the transmission of impulses to the brain. Alcohol dilates blood vessels near the skin's surface, increasing heat loss and lowering body temperature.

Table I provides information on the onset of hypothermia and metabolic responses at different body temperatures.

2. Raynaud's Phenomenon

Raynaud's Phenomenon is the abnormal constriction of the blood vessels of the fingers on exposure to cold temperatures, resulting in blanching of the ends of the fingers. Numbness, itching, tingling or a burning sensation may occur during related attacks. The disease is also associated with the use of vibrating hand tools in a condition sometimes called White Finger Disease. Persistent cold sensitivity, ulceration and amputations can occur in severe cases.

3. Acrocyanosis

Acrocyanosis is caused by exposure to the cold and reduces the level of hemoglobin in the blood, resulting in a slightly blue, purple or gray coloring of the hands and/or feet.

4. Frostbite

Frostbite is the freezing of the body tissues due to exposure to extremely low temperatures, resulting in damage to and loss of tissue.

Frostbite occurs because of inadequate circulation and/or insulation, resulting in freezing of fluids around the cells of the body tissues. Most vulnerable parts of the body are the nose, cheeks, ears, fingers and toes.

Frostbite can affect outer layers of skin or can include the tissues beneath. Damage can be serious, with permanent loss of movement in the affected parts, scarring, necrotic tissue, and amputation are all possibilities. Skin and nails that slough off can grow back.

The freezing point of the skin is about 30F. As wind velocity increases, heat loss is greater and frostbite will set in more rapidly.

There are three (3) degrees of frostbite: first degree, freezing without blistering and peeling; second degree, freezing with blistering and peeling; and, third degree, freezing with death of skin tissues and possibly the deeper tissues.

The following are symptoms of frostbite:

- a. Skin changes color to white or grayish-yellow, progresses to reddish-violet, and finally turns black as the tissue dies;
- b. Pain may be felt at first, but subsides;
- c. Blisters may appear;
- d. Affected part is cold and numb.

The first symptom of frostbite is usually an uncomfortable sensation of coldness followed by numbness. Tingling, stinging, cramping and aching feelings will be experienced by the victim. Frostbite of the outer layer of the skin has a waxy or whitish look and is firm to the touch. Cases of deep frostbite cause severe injury. The tissues are cold, pale and solid. The victim is often unaware of the frostbite until someone else observes these symptoms. It is therefore important to use the "buddy system" when working in cold environments, so that any symptoms of overexposure can be noted.

Table II describes the cooling power of wind on exposed flesh. This information can be used as a guide for determining equivalent chill temperatures when the wind is present in cold environments.

5. Trench Foot and Chilblains

Trench foot is swelling of the foot caused by long, continuous exposure to cold without freezing, combined with persistent dampness or immersion in water.

Edema (swelling), tingling, itching and severe pain occurs, followed by blistering, necrotic tissue and ulcerations. Chilblains have similar symptoms as trench foot, except that other areas of the body are affected.

6. Frostnip

Frostnip occurs when the face or extremities are exposed to a cold wind, causing the skin to turn white.

1.7.5 Prevention of Cold Stress

Cold Stress can be prevented through a combination of various factors: acclimation; water and salt displacement; medical screening, proper clothing selection; and, training and education. Through the use of engineering controls, work practices, work/rest schedules, environmental monitoring and consideration of the wind-chill temperature, the employee can be protected.

1. Acclimatization

Acclimation can be achieved to some degree. Sufficient exposure to cold causes the body to undergo changes to increase comfort and reduce the risk of injury. But, these changes are minor and require repeated exposure to cold and uncomfortable temperatures to induce them.

2. Dehydration

The dryness of cold air causes the body to lose a significant amount of water through the skin and lungs. It is essential that caffeine-free, non-alcoholic beverages be available at the worksite for fluid replacement. Dehydration also increases the risk of injury due to cold and affects blood flow to the extremities.

3. Diet

A well-balanced diet is important for employees working in cold environments. Diets restricted only to certain foods may not provide the necessary elements for the body to withstand cold stress, leaving the worker vulnerable.

4. Control Measures

When the wind chill factor results in an equivalent temperature of -26°F, continuous exposure of the skin will not be permitted.

Any worker exposed to temperatures of 36°F or less that becomes immersed in water will be given dry clothing immediately and treated for hypothermia at the local hospital if any symptoms of hyperthermia are present. Notification of this incident will be provided to the Health and Safety Division immediately after sending the worker to the hospital.

5. Engineering Controls

The following are some ways that environmental controls can be used to reduce the effects of a cold environment:

- a. General or spot heating should be used to increase temperature in certain areas in the workplace;
- b. Warm air jets, radiant heaters or contact warm plates can be used to warm the worker's hands if fine work is to be performed with bare hands for 10 to 20 minutes or more;
- c. Shield the work area if air velocity at the work site is increased by wind, draft or ventilating equipment;
- d. Metal handles of tools and control bars should be covered with thermal insulating material at temperatures below 30°F;
- e. Unprotected metal chair seats will not be used in cold environments;
- f. When appropriate and feasible, equipment and processes will be substituted, isolated, relocated, or redesigned;
- g. Power tools, hoists, cranes or lifting aids will be used to reduce the metabolic workload;
- h. Heated warming shelters will be made available for continuous work being performed in an equivalent temperature of 20°F or below. Workers will be encouraged to use the shelters regularly.

6. Administrative Work Practice Controls

Work practices and guidelines can be designed and developed to reduce exposure to cold stress. Some of these may include:

- a. Work-rest schedules to reduce the peak of cold stress;

- b. Enforce scheduled breaks;
- c. Enforce intake of warm caffeine-free, non-alcoholic beverages;
- d. Schedule work that has potential exposure to cold stress for the warmest part of the day;
- e. Move work to warmer areas, whenever possible;
- f. Assign extra workers for high-demand tasks;
- g. Provide relief workers for other workers needing breaks;
- h. Teach basic principles of recognizing and preventing cold stress;
- i. Use the buddy system for work at 10°F or below, and keep within eyeshot;
- j. Allow new employees to adjust to the conditions before they work full-time in cold environments;
- k. Minimize sitting and standing in one place for long periods of time;
- l. Include weight and bulkiness of clothing when estimating work performance requirements and weights to be lifted;

Table III provides a work/warm-up schedule for cold environments, with wind chill taken into account.

7. Special Considerations

Older workers and workers with circulatory problems should be extra careful in cold environments. Sufficient sleep and good nutrition are important preventive measures for maintenance tolerance to the cold. Double shifts and overtime work should be avoided when working in cold environments.

If any of the following symptoms are observed on site, the affected worker will immediately go to warm shelter:

- Onset of heavy shivering;
- Frostnip;
- Feeling of excessive fatigue;
- Drowsiness;
- Euphoria.

After entering the warm shelter, the outer layer of clothing should be removed. If the clothing is wet from sweat and perspiration, dry clothing should be provided. If this is not feasible, then the clothing should be loosened to allow sweat to evaporate.

Anyone working in cold environments and on prescribed medication should consult their physician concerning any possible side effects due to cold stress. Those individuals suffering from diseases and/or taking medication that interferes with normal body temperature regulation or reduces the tolerance to cold will not be allowed to work in temperatures of 30°F or below.

1.7.6 Personal Protective Equipment (PPE)

In choosing PPE for cold environments, it is important to maintain airspace between the body and outer layer of clothing to retain body heat. The more air pockets, the better the insulation. The clothing should also allow for the evaporation of sweat if the skin is wet.

The most important parts of the body to protect are the feet, hands, head and face. Hands and feet become cooled most easily, because of their distance from the heart. Keeping the head covered is equally important. As much as 40% of body heat loss is through the head when it is exposed.

Ideal clothing for exposure to cold environments is made of cotton. Cotton picks up sweat off the body and brings it to the surface. Loosely fitted clothing also aids in sweat evaporation. Recommended clothing may include the following:

- a. Polypropylene under shirt and shorts under thermal underwear (preferably two-piece);
- b. Wool socks;
- c. Wool or thermal pants, lapped over boot tops to keep out snow and water;
- d. Suspenders (belts can constrict and reduce circulation);
- e. Insulated work boots, preferably waterproof. Safety toe, if necessary;
- f. Wool or cotton shirt;
- g. Parka;
- h. Knit cap/hard hat liner;

- i. Wool mittens or gloves (depending on the dexterity required);
- j. Face mask or scarf.

Dirty or greasy clothing loses much of its insulation value. Dirty clothing crushes air pockets, allowing air to escape more easily. Also, denim is not a good protective fabric. It is loosely woven and allows water to penetrate and wind to blow away body heat.

TABLE I

Progressive Clinical Presentation of Hypothermia*

Core Temperature		Clinical Signs
Deg. C	Deg. F	
37.6	99.6	"Normal" rectal temperature.
37	98.6	"Normal" oral temperature.
36	96.8	Metabolic rate increases in an attempt to compensate for heat loss.
35	95.0	Maximum shivering.
34	93.2	Victim conscious and responsive, with normal blood pressure.
33	91.4	Severe hypothermia below this temperature.
32	89.6	Consciousness clouded; blood pressure becomes difficult to obtain;
31	87.8	Pupils dilated but react to light; shivering ceases.
30	86.0	Progressive loss of consciousness; muscular rigidity increases;
29	84.2	Pulse and blood pressure difficult to obtain; respiratory rate decreases.
28	82.4	Ventricular fibrillation possible with myocardial irritability.
27	80.6	Voluntary motion ceases; pupils non-reactive to light; deep tendon and superficial reflexes absent.
26	78.8	Victim seldom conscious.
25	77.0	Ventricular fibrillation may occur spontaneously.
24	75.2	Pulmonary edema.
22	71.6	Maximum risk of ventricular fibrillation.
20	68.0	Cardiac standstill.
18	64.4	Lowest accidental hypothermia victim to recover.
17	62.6	Isoelectric electroencephalogram.
9	48.2	Lowest artificially cooled hypothermia patient to recover.

* Presentations approximately related to core temperature. Reprinted from the January 1982 issue of American Family Physician, published by the American Academy of Family Physicians.

TABLE II
Cooling Power of Wind on Exposed Flesh as Equivalent Temperature
(under calm conditions)*

Estimated Wind Speed (mph)	Actual Temperature Reading (Degrees Fahrenheit)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect).	LITTLE DANGER In < a hr with dry skin. Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within one minute.			GREAT DANGER Flesh may freeze within 30 seconds.				
	Trenchfoot and immersion foot may occur at any point on this chart.											

* Developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA

Note #1: Wind speeds greater than 40 mph have little additional effect.

Note #2: Trenchfoot and immersion foot may occur at any point on this chart

TABLE III
Threshold Limit Values Work/Warm-up Schedule for 4 Hour Shift (*)

Air Temp.-Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx)	°F (approx)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	(Norm. Breaks) 1		(Norm. Breaks) 1		75 min.	2	55 min.	3	40 min.	4
-29° to -31°	-20° to -24°	(Norm. Breaks) 1		75 min	2	55 min.	3	40 min.	4	30 min.	5
-32° to -34°	-25° to -29°	75 min	2	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min.	4	30 min.	5	Non-emergency work should cease					
-40° to -42°	-40° to -44°	30 min.	5	Non-emergency work should cease							
-43° & below	-45° & below	Non-emergency work should cease									

Notes for TABLE III:

- Schedule applies to moderate to heavy work activity with warm-up breaks of 10 minutes in a warm location. For light to moderate work (limited physical motion), apply the schedule one step lower. For example, at -30°F with no noticeable wind (step 4, a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4 hour period.
- The following is suggested as a guide for estimating wind velocity if accurate information is not available: 5 mph, light flag moves; 10 mph, light flag fully extended; 15 mph, raises newspaper sheet; 20 mph, blowing drifting snow.
- If only the wind-chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be:

- 1) special warm-up breaks should be initiated at a wind-chill cooling rate of about 17 W/m²;
 - 2) all non-emergency work should have ceased at or before a wind-chill of 2250 W/m². In general the warm-up schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart over-compensates for the actual temperatures in the colder ranges, since windy conditions prevail at extremely low temperatures.
4. TLVs apply only for workers in dry clothing.

* Adapted from Occupational Health and Safety Division, Saskatchewan Department of Labour.

1.8 Heat Stress Program

1.8.1 Introduction

Heat stress is one of the most common (and potentially serious) illnesses at job sites. Although it is caused by a number of interacting factors, the wearing of personal protective equipment (PPE) puts the worker at a much higher risk during warmer environmental conditions. The results of heat stress range from fatigue to serious illness or death. Through regular fluid replacement and other preventive measures, heat stress can be controlled, leading to increased efficiency and a higher level of safety on the job.

1.8.2 Purpose

To create an awareness among employees concerning the body's physiologic responses to heat; different types of heat stress that can affect the body; recognition of signs and symptoms; first aid treatment; and, preventive measures.

1.8.3 Sources of Heat

There are two sources of heat that are important to anyone working in a hot environment:

- Internally generated metabolic heat;
- Externally imposed environmental heat.

1.8.4 Physiologic Responses to Heat

The human body maintains a fairly constant internal temperature, even though it is exposed to varying environmental temperatures. To keep internal body temperatures within safe limits, the body must get rid of its excess heat, primarily through varying the rate and amount of blood circulation through the skin and the release of fluid onto the skin by the sweat glands.

These automatic responses usually occur when the temperature of the blood exceeds 98.6°F and are kept in balance and controlled by the brain. In this process of lowering internal body temperature, the heart begins to pump more blood, blood vessels expand to accommodate the increased flow, and the microscopic blood vessels (capillaries) which thread through the upper layers of the skin begin to fill with blood. The blood circulates closer to the surface of the skin, and the excess heat is lost to the cooler environment.

If the heat loss from increased blood circulation through the skin is not adequate, the brain continues to sense overheating and signals the sweat glands in the skin to release large quantities of sweat onto the skin surface. Evaporation of sweat cools the skin, eliminating large quantities of heat from the body.

As environmental temperatures approach normal skin temperature, cooling of the body becomes more difficult. If air temperature is as warm as or warmer than the skin, blood brought to the body surface cannot lose its heat. Under these conditions, the heart continues to pump blood to the body surface, the sweat gland pour liquids containing electrolytes onto the surface of the skin, and the evaporation of the sweat becomes the principal effective means of maintaining a constant body temperature. Sweating does not cool the body unless the moisture is removed from the skin by evaporation. In high humidity, the evaporation of sweat from the skin is decreased and the body's efforts to maintain an acceptable body temperature may be significantly impaired. These conditions adversely affect an individual's ability to work in the hot environment. With so much blood going to the external surface of the body, relatively less goes to the active muscles, the brain, and other internal organs; strength declines; and fatigue occurs sooner than it would otherwise. Alertness and mental capacity also may be affected. Workers who must perform delicate or detailed work may find their accuracy suffering, and others may find their comprehension and retention of information lowered.

When temperature differences exist between two or more bodies, heat can be transferred. Net heat transfer is always from the body (or object) of higher temperature to that of lower temperature and occurs by one or more of the following mechanisms:

Conduction. The transfer of heat from one point to another within the body, or from one body to another when both bodies are in physical contact. Conduction can be a localized source of discomfort from direct physical contact with a hot or cold surface, it is normally not a significant factor to total heat stress.

Convection. The transfer of heat from one place to another by moving gas or liquid. Natural convection results from differences in density caused by temperature differences. Thus warm air is less dense than cool air.

Radiation. The process by which energy, electromagnetic (visible and infrared), is transmitted through space without the presence or movement of matter in or through this space.

1.8.5 Predisposing Factors To Heat Stress

Factors that may predispose an individual to heat stress vary according to the individual. These factors include:

- Lack of physical fitness;
- Lack of acclimatization;
- Age;
- Dehydration;
- Obesity;
- Drug/alcohol abuse;
- Infection;
- Sunburn;
- Diarrhea;
- Chronic disease.

Predisposing factors and an increased risk of excessive heat stress are both directly influenced by the type and amount of PPE worn. PPE adds weight and bulk, reduces the body's access to normal heat exchange mechanisms (evaporation, convection and radiation) and increases energy expenditure.

1.8.6 Forms Of Heat Stress And First Aid

(The following excerpts were taken from NIOSH Publication No. 86-112, Working in Hot Environments):

"Excessive exposure to a hot work environment can bring about a variety of heat-induced disorders. Among the most common are heat stroke, heat exhaustion, heat cramps, fainting and heat rash.

Heat Stroke

Heat Stroke is the most serious of health problems associated with working in hot environments. It occurs when the body's temperature regulatory system fails and sweating becomes inadequate. The body's only effective means of removing excess heat is compromised with little warning to the victim that a crisis stage has been reached.

A heat stroke victim's skin is hot, usually dry, red or spotted. Body temperature is usually 105°F or higher, and the victim is mentally confused, delirious perhaps in convulsions, or unconscious. Unless the victim receives quick and appropriate treatment, death can occur.

Individuals with signs or symptoms of heat stroke require immediate hospitalization. First aid should be immediately administered.

This includes removing the victim to a cool area, thoroughly soaking the clothing with water, and vigorously fanning the body to increase cooling. Further treatment, at a medical facility, should be directed to the continuation of the cooling process and the monitoring of complications which often accompany heat stroke. Early recognition and treatment are the only means of preventing permanent brain damage or death.

Heat Exhaustion

Heat Exhaustion includes several clinical disorders having symptoms which may resemble the early symptoms of heat stroke. Heat exhaustion is caused by the loss of large amounts of fluid by sweating, sometimes with excessive loss of salt. A worker suffering from heat exhaustion still sweats but experiences weakness or fatigue, giddiness, nausea or headache. In more serious cases, the victim may vomit or lose consciousness.

The skin is clammy and moist, the complexion is pale or flushed, and the body temperature is normal or only slightly elevated. In most cases, treatment involves having the victim rest in a cool place and drink plenty of liquids. Victims with mild cases of heat exhaustion usually recover spontaneously with this treatment. Those with severe cases may require extended care for several days. There are no known permanent effects.

Heat Cramps

Heat cramps are painful spasms of the muscles that occur among those who sweat profusely in heat, drink large quantities of water, but do not adequately replace the body's salt loss. The drinking of large amounts of water tends to dilute the body's fluids, while the body continues to lose salt. Shortly after, the low salt level in the muscles causes painful cramps. The affected muscles may be part of the arms, legs, or abdomen; but tired muscles (those used in performing the work) are usually the ones most susceptible to cramps. Cramps may occur during or after work hours and may be relieved by taking salted liquids by mouth.

Fainting

Fainting occurs in workers not accustomed to hot environments and who stand erect and immobile in the heat.

With enlarged blood vessels in the skin and in the lower part of the body due to the body's attempts to control internal temperature, blood may pool there rather than return to the heart to be pumped to the brain. Upon lying down, the worker should soon recover. By moving around, and thereby preventing blood from pooling, the patient can prevent further fainting.

Heat Rash (Prickly Heat)

Heat rash, also known as prickly heat, is likely to occur in hot, humid environments where sweat is not as easily removed from the surface of the skin by evaporation and the skin remains wet most of the time.

The sweat ducts become plugged, and a skin rash soon appears. When the rash is extensive or when it is complicated by infection, prickly heat can be very uncomfortable and may reduce a worker's performance. The worker can prevent this condition by resting in a cool place part of each day and by regularly bathing and drying the skin.

1.8.7 Selection of Personal Protective Equipment (PPE)

During work periods where the increased risk of heat stress exists, each item's benefit will be carefully evaluated. Once the PPE is chosen, safe work durations/rest periods will be determined based on the following conditions.

- Anticipated work rate;
- Ambient temperature and humidity;
- Level of protection.

1.7.8 Prevention of Heat Stress

Prevention of heat stress will be addressed in the following manner:

1. Adjustment of work schedules.
 - a. Modify work/rest schedules.
 - b. Enforce work slowdowns, as needed.
 - c. Rotate personnel to minimize overstress or overexertion.
 - d. When possible, work will be scheduled and performed during cooler hours.
2. Provide shelter or shaded areas to protect personnel during rest periods.
3. Maintain worker's body fluids at normal levels.
 - a. Drink approximately 12 to 16 ounces of non-caffeinated liquid (preferably water, Gatorade or equivalent) prior to the start of work. Caffeinated fluids act to dehydrate the worker.
 - b. Workers will be urged to drink a cup or two every 15 to 20 minutes, or at each break. A total of 1 to 1.5 gallons of water per individual per day are recommended for fluid replacement under heat stress conditions, but more may be required.

4. Encourage physical fitness among the workers.
 - a. Gradually acclimatize workers on site to help build up an "immunity" to the conditions.
 - b. Heat acclimatization can usually be induced in 5 to 7 days of exposure at a hot job. For workers with previous experience with the job, acclimatization will include exposures of 50% for day 1, 60% for day 2, 80% for day 3, and 100% for the remaining additional days.
5. Provide cooling devices during prolonged work or severe heat exposure.
 - a. Supply field showers or hose down areas.
 - b. Supply personnel with cooling jackets, vests, and suits.
6. Train workers in recognition and treatment of heat stress.
7. Use of the buddy system that depends on the recognition of signs and symptoms of heat stress.
8. Identification of heat-intolerant individuals through medical screening.

1.9 Biological Hazards

During the course of the project, there is a potential for workers to come into contact with biological hazards such as animals, insects, plants, and sewage. Workers should be aware of these potential hazards that are discussed below.

Animals

During the conduct of site operations, wild animals such as stray dogs or cats, raccoons, and rats may be encountered. Workers shall use discretion and avoid all contact with wild animals. If these animals present a problem, efforts will be made to remove these animals from the Site by contacting a licensed animal control technician.

Insects

Insects, including bees, wasps, hornets, mosquitoes, ticks, and spiders, may be present at the Site making the chance of a bite possible. Some individuals may have a severe allergic reaction to an insect bite or sting that can result in a life threatening condition. Some insect bites can transmit diseases such as Lyme Disease or a virus such as West Nile; any individuals who have been bitten or stung by an insect should notify the SSO. The following is a list of preventive measures:

- Apply insect repellent prior to performing any field work and as often as needed throughout the work shift.
- Wear proper protective clothing (work boots, socks and light colored pants).
- When walking in wooded areas, avoid contact with bushes, tall grass, or brush as much as possible.
- Field personnel who may have insect allergies shall have bee sting allergy medication on site and should provide this information to the SSO prior to commencing work.

Lyme disease

Lyme disease is caused by infection from a deer tick that carries a spirochete. During the painless tick bite, the spirochete may be transmitted into the bloodstream often after feeding on the host for 12 to 24 hours. The ticks that cause the disease are often no bigger than a poppy seed or a comma in newsprint. The peak months for human infection are from May to September.

Symptoms appear in three stages. First symptoms usually appear from 2 days to a few weeks after a person is bitten by an infected tick. Symptoms usually consist of a ring-like red rash on the skin where the tick was attached. The rash is often bulls-eye like with red on the outside and clear in the center. The rash may be warm, itchy, tender, and/or "doughy." Unfortunately, this rash appears in only 60 to 80% of infected persons. An infected person also has flu-like symptoms of a stiff neck, chills, fever, sore throat, headache, fatigue and joint pain. These symptoms often disappear after a few weeks.

The second stage symptoms, which occur weeks to months later include meningitis, severe headache, drooping of the muscles on the face, called Bell's Pals, encephalitis, numbness, withdrawal and lethargy. These symptoms may last for several weeks to several months. Third stage symptoms, which occur months or years later include arthritis, heart problems, and loss of memory. The third stage symptoms may mimic multiple sclerosis and Alzheimer's disease.

It is recommended that personnel check themselves when in areas that could harbor deer ticks, wear light color clothing and visually check themselves and their buddy when coming from wooded or vegetated areas. If a tick is found biting an individual, the SSO should be contacted immediately. The tick can be removed by pulling gently at the head with tweezers. If tweezers are not available, cover your fingers (e.g., tissue paper) and use to grasp the tick. It is important to grasp the tick as close to the site of attachment and use a firm steady pull to remove it. Wash hands immediately after with soap and water. The affected area should then be disinfected with an antiseptic wipe. All mouth parts must be removed from the skin.

If the tick is removed with breaking off the mouth parts, an irritation or infection may occur. Also, the organism that is causing the disease can still enter the body through the skin.

The employee will be offered the option for medical treatment by a physician, which typically involves antibiotics. If personnel feel sick or have signs similar to those above, they should notify the SSO immediately.

Treatment with antibiotics is effective and recovery is usually complete. In the first stage antibiotics are usually given orally. Second and third stage treatment, however is prolonged and recovery may take longer. Antibiotic treatment is usually provided intravenously for second and third stage Lyme disease.

West Nile Virus

West Nile Virus (WNV) is a mosquito-borne infection transmitted through the bite of an infected mosquito. The symptoms of WNV can be asymptomatic (no symptoms) or in more serious cases can lead to West Nile fever.

West Nile Fever can include fever, headache, tiredness, body ache, an occasional rash on the trunk of the body, and swollen lymph glands. In severe cases, people have developed West Nile encephalitis or meningitis which symptoms include fever, headache, neck stiffness, tremors, coma and in some cases death. The incubation period for the disease is usually 2 to 15 days. The symptoms can range from a few days to several weeks.

Since the initial outbreak in 1999, the virus has spread rapidly throughout New York State. There are about 65 different species of mosquitoes in New York State, but only a small percentage has been associated with the WNV. Most mosquitoes are not infected and the chance of infection from a mosquito bite of an on-site worker is very small. All residents of areas where virus activity has been identified are at risk of getting WNV, but those of the highest risk for becoming seriously ill from WNV are people who are over 50 and individuals with some immunocompromised person (transplant patients).

The following precautions will be used to help reduce the risk of mosquito bites:

- Reduce mosquito-breeding areas by making sure wheelbarrows, buckets, and other containers are turned upside down when not used so that they do not collect standing water.
- Wear shoes, long pants with bottoms tucked into boots or socks, and a long-sleeved shirt when outdoors for long periods of time, or when many mosquitoes are most active (between dawn and dusk).
- Use mosquito repellent according to the manufacturer's directions when outdoors for long periods of time and when mosquitoes are most active.

Plants

The potential for contact with poisonous plants exists when performing fieldwork in undeveloped and wooded areas.

Poison ivy, sumac, and oak may be present on site. Poison ivy can be found as vines on tree trunks or as upright bushes. Poison ivy consists of three leaflets with notched edges. Two leaflets form a pair on opposite sides of the stalk, and the third leaflet stands by itself at the tip. Poison ivy is red in the early spring and turns shiny green later in the spring.

Poison sumac can be present in the form of a flat-topped shrub or tree. It has fern-like leaves, which are velvety dark green on top and pale underneath. The branches of immature trees have a velvety "down." Poison sumac has white, "hairy" berry clusters. Poison oak can be present as a sparingly branched shrub. Poison oak is similar to poison ivy in that it has the same leaflet configuration; however, the leaves have slightly deeper notches. Prophylactic application of Tecnu[®] may prevent the occurrence of exposure symptoms. Post exposure over the counter products are available and should be identified at the local pharmacist. Susceptible individuals should identify themselves to the SSO.

Contact with poison ivy, sumac, or oak may lead to a skin rash, characterized by reddened, itchy, blistering skin which needs first aid treatment. If you believe you have contacted one of these plants, immediately wash skin thoroughly with soap and water, taking care not to touch your face or other body parts.

Blood Poisoning

Blood poisoning is a term used to indicate a large number of bacteria present in the circulating blood. The most common symptom of blood poisoning is the reddening of skin which advances toward the heart. For example, if the point of contact is the hand, then a red line will appear at the hand and extend up the arm towards the heart.

Signs and symptoms include swelling, stiffness and tenderness in the affected area, fatigue, chills and fever, pustules, abscesses. If allowed to progress without treatment, the organisms may multiply and cause an overwhelming infection which can lead to death.

Personal protective equipment shall be worn to prevent direct contact with equipment that may be contaminated with bacteria such as well caps and soil.

Sewage and Bacterial Impacted Sediments

The Gowanus Canal has served as a combined sewer overflow and consequently has received untreated sanitary sewage from numerous outfalls throughout the canal. Decomposed sewage will potentially be encountered within canal sediments. The USACE investigation identified elevated concentrations of bacteria in canal sediments.

USACE investigation data is located in Appendix K. Bacteria species identified in the Gowanus Canal sediments include soil and marine microorganisms, and bacterium associated with sewage.

May of these bacterium can cause illness through ingestion, direct contact, or the inhalation of a bio-aerosol. Potential respiratory exposure to biological agents can also occur through the inhalation of aerosols produced during sediment handling activities. Personal protective equipment as specified in Section 6.0 will be worn to minimize potential exposures. Personal will use decontamination procedures identified in Section 10.0.

1.10 Evaluation of Potential Chemical Hazards

Previous sampling of surfaces in the structures on site found levels of metals and volatile organic compounds (VOCs) that have the potential to be present in fugitive dust and organic vapor produced during environmental investigation. The potential primary hazards of each contaminant are identified as follows. Note that the matrices specified for each contaminant are not necessarily exclusive but are based on the best existing information of the site. This HASP is intended to be sufficiently stringent to ensure GEI personnel protection from all of the potential contaminants listed, regardless of matrix.

Metals

The metal constituents of concern (COCs) historically detected on site include Copper, Lead, Tin, Silver, Arsenic, Mercury, Cyanide, Barium, Cadmium, Nickel, Chromium (total), Zinc. The primary route of metals exposure is through inhalation of dust particles when environmental drilling activities are initiated. Other routes of exposure for metals include ingestion and skin contact. Acute health effects for individual metals are provided below.

Volatile Organic Compounds

Volatile Organic Compounds (VOCs) have previously been encountered in the groundwater at this site. In particular, tetrachloroethylene (PCE), trichloroethylene (TCE), and vinyl chloride have been detected site wide. VOCs have historically been used from a number of sources including, but not limited to; degreasing operations and components of elastics and paints. Exposure to VOCs is mostly likely through inhalation of fumes. Acute and chronic effects of the exposure are provided below.

CONTAMINANT:	Copper			
Possible Sources:	Dust, contaminated soil and groundwater			
Form:	Gas <input type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input checked="" type="checkbox"/>	Other <u>dust</u>
Characteristic:	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input checked="" type="checkbox"/>	Debris <input type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other <u>concrete chips</u>

CONTAMINANT:	Lead			
Possible Sources:	Dust, contaminated soil and groundwater			
Form:	Gas <input type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input checked="" type="checkbox"/>	Other <u>dust</u>
Characteristic:	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input checked="" type="checkbox"/>	Debris <input type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other concrete chips

CONTAMINANT:	Tin			
Possible Sources:	Dust, contaminated soil and groundwater			
Form:	Gas <input type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input checked="" type="checkbox"/>	Other <u>dust</u>
Characteristic:	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input checked="" type="checkbox"/>	Debris <input type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other concrete chips

CONTAMINANT:	Silver			
Possible Sources:	Dust, contaminated soil and groundwater			
Form:	Gas <input type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input checked="" type="checkbox"/>	Other <u>dust</u>
Characteristic:	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input checked="" type="checkbox"/>	Debris <input type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other concrete chips

CONTAMINANT:	Arsenic			
Possible Sources:	Dust, contaminated soil and groundwater paint chips and dust			
Form:	Gas <input type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input checked="" type="checkbox"/>	Other <u>dust</u>
Characteristic:	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input checked="" type="checkbox"/>	Debris <input type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other concrete chips

CONTAMINANT:	Mercury			
Possible Sources:	Dust, contaminated soil and groundwater paint chips and dust			
Form:	Gas <input type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input checked="" type="checkbox"/>	Other <u>dust</u>
Characteristic:	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input checked="" type="checkbox"/>	Debris <input type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other concrete chips

CONTAMINANT:	Cyanide			
Possible Sources:	Dust, contaminated soil and groundwater paint chips and dust			
Form:	Gas <input type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input checked="" type="checkbox"/>	Other <u>dust</u>
Characteristic:	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input checked="" type="checkbox"/>	Debris <input type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other concrete chips

CONTAMINANT:	Barium			
Possible Sources:	Dust, contaminated soil and groundwater paint chips and dust			
Form:	Gas <input type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input checked="" type="checkbox"/>	Other <u>dust</u>
Characteristic:	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input checked="" type="checkbox"/>	Debris <input type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other concrete chips

CONTAMINANT:	Chromium (Total)			
Possible Sources:	Dust, contaminated soil and groundwater paint chips and dust			
Form:	Gas <input type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input checked="" type="checkbox"/>	Other <u>dust</u>
Characteristic:	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input checked="" type="checkbox"/>	Debris <input type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other concrete chips

CONTAMINANT:	Cadmium			
Possible Sources:	Dust, contaminated soil and groundwater paint chips and dust			
Form:	Gas <input type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input checked="" type="checkbox"/>	Other <u>dust</u>
Characteristic:	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input checked="" type="checkbox"/>	Debris <input type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other concrete chips

CONTAMINANT:	Nickel			
Possible Sources:	Dust, contaminated soil and groundwater paint chips and dust			
Form:	Gas <input type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input checked="" type="checkbox"/>	Other <u>dust</u>
Characteristic:	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input checked="" type="checkbox"/>	Debris <input type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other concrete chips

CONTAMINANT:	Zinc			
Possible Sources:	Dust, contaminated soil and groundwater paint chips and dust			
Form:	Gas <input type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input checked="" type="checkbox"/>	Other <u>dust</u>
Characteristic:	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input checked="" type="checkbox"/>	Debris <input type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other concrete chips

CONTAMINANT:	Trichloroethylene (TCE)			
Possible Sources:	Degreasing and residual industrial products			
Form:	Gas <input checked="" type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input type="checkbox"/>	Other <u>dust</u>
Characteristic:	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input type="checkbox"/>	Debris <input checked="" type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other concrete chips

CONTAMINANT:	Perchloroethylene (PCE)
Possible Sources:	Degreasing and residual industrial products

CONTAMINANT:	Vinyl Chloride			
Possible Sources:	Degreasing and residual industrial products			
Form: Characteristic:	Gas <input checked="" type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input type="checkbox"/>	Other dust
	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input type="checkbox"/>	Debris <input checked="" type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other concrete chips
Form: Characteristic:	Gas <input checked="" type="checkbox"/>	Liquid <input type="checkbox"/>	Solids (absorbed) <input type="checkbox"/>	Other dust
	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input type="checkbox"/>
Matrix	Soils <input type="checkbox"/>	Debris <input checked="" type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other concrete chips

CONTAMINANT:	Methanol			
Possible Sources:	Preservative for Soil Samples			
Form: Characteristic:	Gas <input type="checkbox"/>	Liquid <input checked="" type="checkbox"/>	Solids (absorbed) <input type="checkbox"/>	Other _____
	Corrosive <input type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input checked="" type="checkbox"/>	Reactive <input type="checkbox"/>	Other _____	Unknown <input checked="" type="checkbox"/>
Matrix	Soils <input type="checkbox"/>	Debris <input type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other Sample jar

CONTAMINANT:	Hydrochloric Acid			
Possible Sources:	Preservative for groundwater samples.			
Form: Characteristic:	Gas <input type="checkbox"/>	Liquid <input checked="" type="checkbox"/>	Solids (absorbed) <input type="checkbox"/>	Other _____
	Corrosive <input checked="" type="checkbox"/>	Ignitable <input type="checkbox"/>	Radioactive <input type="checkbox"/>	Volatile <input type="checkbox"/>
	Toxic <input type="checkbox"/>	Reactive <input type="checkbox"/>	Other Sample jar	Unknown <input type="checkbox"/>
Matrix	Soils <input type="checkbox"/>	Debris <input checked="" type="checkbox"/>	Groundwater <input checked="" type="checkbox"/>	Other Sample jar

Material Safety Data Sheets (MSDS) (as available) and/or Occupational Health Guidelines for contaminants potentially found at the site (and/or for products that are potentially the source of contamination), and for decontamination chemicals that may be used on site, are included in Appendix A.

Specific chemical hazards information from the MSDS and Occupational Health Guidelines are summarized below.

Contaminant	CAS No.	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Properties
Lead	7439-92-1	0.05 mg/m ³ A.L. 0.03 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Weakness, insomnia; facial pallor; pal eye, anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis of wrist and ankles; irritates eyes, hypo tension	Eyes, GI tract, CNS, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid. FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm
Copper	7440-50-8	1 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, respiratory system, cough, dyspnea, wheezing	Eyes, skin, respiratory system, liver, kidneys	Reddish, lustrous, malleable, odorless solid
Tin	7440-31-5	2 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system	Eyes, skin, respiratory system, liver, kidneys	Gray to almost silver-white, ductile, malleable, lustrous solid
Silver	7440-22-4	0.01 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Blue-gray eyes, nasal septum, throat, skin, irritation, ulceration skin, gastrointestinal disturbance	Eyes, skin, respiratory system, liver, kidneys	White, lustrous solid
Arsenic	7440-38-2	0.01 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy	Eyes, skin, respiratory system, liver, kidneys	Metal, silver-gray or tin white, brittle, odorless solid
Mercury	7439-97-6	0.01 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, cough, chest pain, dyspnea, bronchitis, pneumonitis	Eyes, skin, respiratory system, liver, kidneys	Silver-white, heavy, odorless liquid
Barium Chloride (as Ba)	10361-37-2	0.5 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, upper respiratory system, skin burns	Eyes, skin, respiratory system, liver,	White odorless solid

Contaminant	CAS No.	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Properties
					kidneys	
Cadmium	7440-43-9	0.005 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Pulmonary edema, dyspnea, cough, chest tightness, substernal pain	Eyes, skin, respiratory system, liver, kidneys	Silver-white, blue tinged lustrous, odorless solid
Nickel	7440-02-0	1 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Sensitization dermatitis, allergic asthma, pneumonitis,	Eyes, skin, respiratory system, liver, kidneys	Lustrous, silvery, odorless solid
Chromium (total)	7440-47-3	1 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin; lung fibrosis	Eyes, skin, respiratory system, liver, kidneys	Blue-white to steel-gray, lustrous, brittle, hard odorless solid
Zinc	7646-85-7	1 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, cough, dyspnea	Eyes, skin, respiratory system, liver, kidneys	White metal
Trichloroethylene	79-01-6	269 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Acute anesthesia, chronic central nervous system, possible organic injury – probable carcinogen	Eyes, skin, respiratory system, liver, kidneys	Clear Colorless.
Perchloroethylene	127-18-4	25 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Acute anesthesia, chronic central nervous system, possible organic injury – probable carcinogen	Eyes, skin, respiratory system, liver, kidneys	Water-white ethereal
Vinyl Chloride	75-01-4	1 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Acute anesthesia, chronic central nervous system, possible organic injury – probable carcinogen	Eyes, skin, respiratory system, liver, kidneys	Water-white ethereal

Contaminant	CAS No.	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Properties
Methanol	67-56-1	200 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, cough, dyspnea	Kidneys, heart, central nervous system, eyes	Clear, slight alcohol smell
Hydrochloric Acid	7647-01-0	5 mg/m ³	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, cough, dyspnea	Kidneys, heart, central nervous system, eyes	Clear, fuming, pungent odor

Notes:

LEL = Lower explosive limit

mm = millimeter

ppm = parts per million

Skin = significant route of exposure

STEL = Short-term exposure limit (15 minutes)

TWA = Time-weighted average (8 hours)

UEL = Upper explosive limit

VP = vapor pressure approximately 68° F in mm Hg (mercury)

1.11 Levels of Protection Required

PPE required for each level of protection is as follows.

Safety Equipment	Level A	Level B	Level C	Level D
Tyvek™ suit or work overalls				•
Hard hats with splash shields or safety glasses			•	•
Steel-toe boots with overboots			•	•
Chemical-resistant gloves as appropriate for work being performed and materials handled			•	•
Half- or full-face respirators with HEPA cartridges as approved by the CHSO			•	
Tyvek™ splash-resistant suit			•	
Chemical-resistant clothing		•		
Pressure-demand, full-face SCBA or pressure-demand supplied air respirator with escape SCBA		•		
Inner and outer chemical-resistant gloves	•	•		
Chemical-resistant safety boots or shoes	•	•		
Two-way radio	•	•		
Hard hat	•	•		
Fully encapsulating chemical-resistant suit	•			

PPE requirements for field activities are as follows.

Activity	Level of Protection	Backup Protection
Demolition	C	C
Stockpiling debris	C	C
Sampling debris	C or D	C

Use of Level A or Level B PPE is not anticipated. If conditions indicating the need for Level A or Level B PPE are encountered, personnel will leave the exclusion zone and this HASP will be revised or GEI personnel will not re-enter the exclusion zone until conditions allow.

2. Statement of Safety and Health Policy

GEI is committed to providing a safe and healthy work environment for its employees. To maintain a safe work environment, GEI has established an organizational structure and a Corporate Health and Safety Program to promote the following objectives:

- Reduce the risk of injury, illness, and loss of life to GEI employees.
- Maintain compliance with federal, state, and other applicable safety regulations; and minimize GEI employees' work exposure to potential physical, chemical, biological, and radiological hazards.

3. Key Project Personnel/Responsibilities and Lines of Authority

GEI Personnel

- | | |
|---------------------------|---|
| ▪ Frederick Johnson, LEP | GEI Project Manager |
| ▪ Barry Giroux, LEP, P.E. | GEI Project Engineer |
| ▪ Jessie McCusker | GEI Field Representative |
| ▪ Kim Barber | GEI Field Representative |
| ▪ Robin DeHate | GEI Corporate Health and Safety Officer |

Lines of Authority will be as follows:

On site – GEI will have responsibility for safety of its employees during the work performed at the MacDermid facility. GEI's field representative will have a cell phone available to contact the appropriate local authorities, in the event of an emergency. GEI's field representative will be available for communication with the GEI Project Manager and with the MacDermid representative.

4. Subcontractors

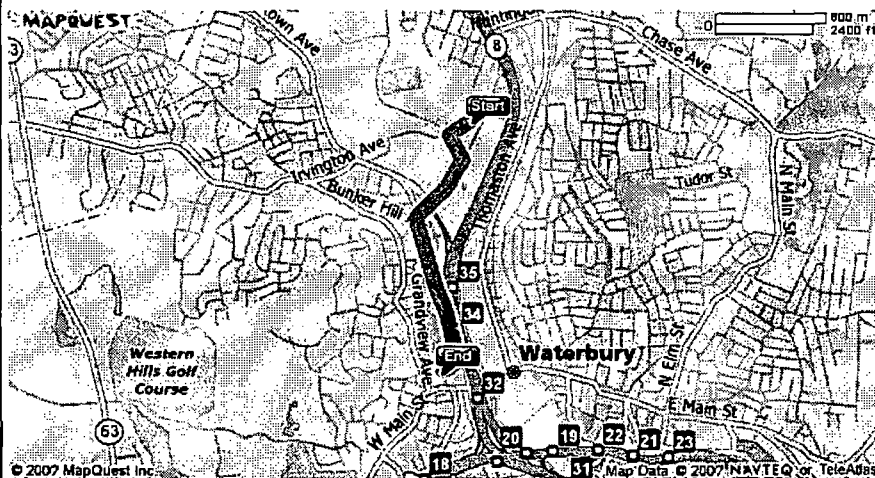
GEI has subcontracted the following firms to assist in performing work on this project:

TO BE ADDED AT LATER DATE

GEI requires its subcontractors to work in a responsible and safe manner. Subcontractors for this project will be required to develop their own HASP for protection of their employees but at a minimum must adhere to applicable requirements set forth in this HASP.

5. Emergency Contact List

EMERGENCY INFORMATION	
Important Phone Numbers	Directions to Hospital
Local Police 911	<div>Total Est. Time: 4 minutes Total Est. Distance: 1.58 miles</div> <div>Directions</div> <div>1. Start out going SOUTHWEST on HUNTINGDON AVE toward GEAR ST.</div> <div>2. Turn LEFT onto GEAR ST.</div> <div>3. Turn LEFT onto GEAR ST.</div> <div>4. Turn RIGHT onto E AURORA ST.</div> <div>5. Turn LEFT onto WATERTOWN AVE.</div> <div>6. Turn SLIGHT RIGHT onto ROBBINS ST.</div> <div>End at Waterbury Hospital: 64 Robbins St, Waterbury, CT 06708, US</div> <div>Total Est. Time: 4 minutesTotal Est. Distance: 1.58 miles</div>
Fire Department 911	
Ambulance 911	
State Police or County Sheriff 911	
Local Hospital (203) 573-6000 Waterbury Hospital	
Project Manager (860) 368-5356 Frederick Johnson office (860) 608-9821 cell	
Corporate Health and Safety Officer Robin DeHate (813) 323-6220 cell	
Client Contact Lawrence E. Miles, REM Director, Environmental Health and Safety 526 Huntingdon Avenue Waterbury, CT (203) 575-5700	
Utility Clearance Permit #	
Nearest Telephone Location: On-site cellular	



6. Training Program

6.1 General Health and Safety Training

In accordance with 29 CFR 1910.120, hazardous waste site workers shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations. At a minimum, the training shall have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training shall not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical). Proof of training shall be submitted to the GEI Corporate Health and Safety Officer or her representative prior to the start of field activities.

6.2 Annual Eight-Hour Refresher Training

Annual eight-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualifications for fieldwork. The training will cover a review of 29 CFR 1910.120 requirements and related company programs and procedures. Proof of current 8-hour refresher training shall be submitted to the GEI Corporate Health and Safety Officer or her representative prior to the start of field activities.

6.3 Supervisor Training

Personnel acting in a supervisory capacity shall have received 8 hours of instruction in addition to the initial 40 hours training. In addition supervisors shall have one year of field experience and training specific to work activities (i.e., sampling, construction observation, etc.).

6.4 Site-Specific Training

Prior to commencement of field activities, the GEI Corporate Health and Safety Officer or her representative will ensure all field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the site operations. It will include site and facility layout, hazards and emergency services at the site and will highlight all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity. Personnel that have not received site-specific training will not be allowed on-site.

6.5 On-Site Safety Briefings

Other GEI personnel will be given health and safety briefings daily by GEI's field representative to assist GEI personnel in safely conducting work activities.

The briefings will include information on new operations to be conducted, changes in work practices or changes in the site's environmental conditions, as well as periodic reinforcement of previously discussed topics. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety inspections. The meetings will also be an opportunity to periodically update the workers on monitoring results.

7. Medical Surveillance Program

GEI maintains a continuous, corporate, medical surveillance program that includes a plan designed specifically for field personnel engaged in work at sites where hazardous or toxic materials may be present. Robin DeHate is GEI's Corporate Health and Safety Officer and is responsible for the administration and coordination of medical evaluations conducted for GEI's employees at all branch office locations. Comprehensive examinations are given to all GEI field personnel participating in hazardous waste operations on an annual or biennial basis (as determined to be appropriate by the CHSO). The medical results of the examinations aid in determining the overall fitness of employees participating in field activities.

Robin DeHate's telephone numbers are:
Mobile: (813) 323-6220 (Fax) 813-654-8055

Under the CHSO's supervision, all field personnel undergo a complete initial physical examination, including a detailed medical and occupational history, before they participate in hazardous waste site investigations. Extensive annual/biennial reexaminations are also performed. Upon completion of these tests, personnel are certified by an occupational health physician as to whether they are fit for field work in general, and fit to use all levels of respiratory protection, in particular.

If a GEI employee or other project worker shows symptoms of exposure to a hazardous substance and wishes to be rechecked, he/she will be directed to the nearest area hospital or medical facility.

All GEI subcontractor personnel that will enter any active waste handling or other active non-"clean" area must certify that they are participating in a medical surveillance program that complies with OSHA regulations for hazardous waste operations (i.e., 29 CFR 1910.120 and 29 CFR 1926.65). Proof of medical clearance shall be submitted to the GEI Corporate Health and Safety Officer or her representative prior to the start of field activities.

8. Site Control Measures

8.1 Site Zones

Site zones are intended to control the potential spread of contamination and to assure that only authorized individuals are permitted into potentially hazardous areas. A three-zone approach will be utilized. It shall include an Exclusion Zone (EZ), Contamination Reduction Zone (CRZ) and a Support Zone (SZ). Specific zones shall be established on the work site by the Contractor when operations begin for each task requiring such delineation. Maps depicting the zones will be available at the Site.

This project is being conducted under the requirements of 29 CFR 1910.120, and any personnel working in an area where the potential for exposure to site contaminants exists, will only be allowed access after proper training and medical documentation.

The following shall be used for guidance in revising these preliminary zone designations, if necessary.

Support Zone - The SZ is an uncontaminated area that will be the field support area for most operations. The SZ provides for field team communications and staging for medical emergency. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone.

Contamination Reduction Zone - The CRZ is established between the EZ and the SZ. The CRZ contains the contamination reduction corridor and provides an area for decontamination of personnel and portable hand-held equipment, tools and heavy equipment. A personnel decontamination area will be prepared at each exclusion zone. The CRZ will be used for Exclusion Zone entry and egress in addition to access for heavy equipment and emergency support services.

Exclusion Zone - All activities which may involve exposure to site contaminants, hazardous materials and/or conditions should be considered an exclusion zone. This zone will be clearly delineated by cones, tapes or other means. The Contractor may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ shall be determined by the Contractor allowing adequate space for the activity to be completed, field members and emergency equipment. The Contractor is responsible for constructing, maintaining, and enforcing the zones.

9. Accident Reporting

GEI will report incidents involving GEI personnel or subcontractor personnel, such as: lost time injuries, injuries requiring medical attention, near miss incidents, fires, fatalities, accidents involving the public, and property damage. The report shall be made to the GEI Project Manager verbally within 2 hours of the incident. The Project Manager will immediately inform the Corporate Health and Safety Officer and the Director of Human Resources of the incident. All occupational injuries and illnesses that are required to be recorded under the Occupational Safety and Health Act will be recorded on Occupational Health and Safety Act's (OSHA) Form 300 by GEI's or the subcontractor's personnel within 48 hours of occurrence as is required by statute.

10. Medical Support

In case of minor injuries, on site care shall be administered with the site first aid kit. For serious injuries, call 911 and request emergency medical assistance. Seriously injured persons should not be moved, unless they are in immediate danger.

Section 5 of this HASP contains detailed emergency information, including directions to the nearest hospital, and a list of emergency services and their telephone numbers. GEI field personnel will carry a cellular telephone.

11. Decontamination Procedures

A decontamination pad will be established for personnel decontamination and equipment decontamination.

11.1 Personnel Decontamination Station

A personnel decontamination station where workers can drop equipment and remove PPE will be set up at the decontamination pad by the Contractor. It will be equipped with basins for water and detergent, and trash bag(s) or cans for containing disposable PPE and discarded materials. Once personnel have decontaminated at this station and taken off their PPE, they will proceed to a sink where they will wash themselves wherever they have potentially been exposed to any contaminants (e.g., hands, face, etc.)

The following specific decontamination procedure will be used as necessary by GEI personnel or subcontractor personnel wearing PPE from Level D through Level C.

- ☐ **Step 1** - Equipment drop (tools, monitoring equipment, etc.). Decontaminate as appropriate (per GEI's field representative's instructions).
- ☐ **Step 2** - Boot wash/rinse (wash with non-foaming detergent, rinse with fresh water spray). Remove boots. If inner and outer gloves are worn, wash outer gloves, remove and save for later use, or remove and discard outer gloves and place in trash bag/can provided in the decontamination area.
- ☐ **Step 3** - Hard hat removal, wash if visibly contaminated (use same wash as in Step 2).
- ☐ **Step 4** - If Tyvek™ (or equivalent) suit was worn and is visibly contaminated, remove and place in trash bag/can provided in the decontamination area or decontaminate (wash) and store for reuse. Contaminated washable coveralls should be removed and bagged for washing.
- ☐ **Step 5** - Respirator and/or eye protection removal (as applicable). Wash (per Step 2) to remove visible contamination.
- ☐ **Step 6** - Glove removal.
- ☐ **Step 7** - Wash potentially exposed skin (use water and soap at indoor sink).
- ☐ **Step 8** - Disinfect respirator per manufacturer's recommendations.

Contaminated PPE (gloves, suits, etc.) will be decontaminated and stored for reuse or placed in plastic bags (or other appropriate container) and disposed of in an approved facility. Decontamination wastewater and used cleaning fluids will be collected and disposed of in accordance with all applicable state and federal regulations.

11.2 Decontamination Equipment Requirements

The following equipment shall be in sufficient supply to implement decontamination procedures for GEI's equipment.

- ☐ Buckets
- ☐ Alconox™ detergent concentrate
- ☐ Hand pump sprayers
- ☐ Long handle soft bristle brushes
- ☐ Large sponges
- ☐ Cleaning wipes for respirators
- ☐ Bench or stool(s)
- ☐ Methanol
- ☐ Liquid detergent and paper towels
- ☐ Plastic trash bags

The Contractor performing decontamination procedures is responsible for ensuring that the above materials, as required for their operation, are in sufficient supply.

12. Personal Protective Equipment

Personal protective equipment will include hardhats, protective coveralls (e.g. Tyvek®), boot covers, safety glasses, face shields steel toe boots, half-mask air purifying respirators equipped with lead cartridges (when necessary), ear protection, nitrile (or latex) gloves, and leather or Kevlar gloves. Site activities and their associated PPE are outlined in Section 1 of this HASP.

13. Supplemental Contingency Plan Procedures

Hazard Communication Plan

GEI personnel have received hazard communication training as part of their 40-hour HAZWOPER training. All hazardous materials used on the site will be properly labeled, stored, and handled. Material Safety Data sheets (MSDS) will be available to all potentially exposed employees.

Fire

In the event of a fire all personnel will evacuate the area. GEI's field representative will contact the local fire department with jurisdiction and report the fire. Notification of evacuation will be made to the GEI Project Manager and the CHSO. The field representative will account for GEI personnel and subcontractor personnel and report their status to the GEI Project Manager.

Severe Weather

The contingency plan for severe weather includes reviewing the expected weather to determine if severe weather is in the forecast. Severe weather includes high winds over 30 mph, heavy rains or snow squalls, thunderstorms, hurricanes, and lightning storms. If severe weather is approaching, the decision to evacuate GEI personnel and subcontractor personnel from the site will be the responsibility of GEI's field representative. Notification of evacuation will be made to the GEI Project Manager. The field representative will account for GEI personnel and subcontractor personnel and report their status to the GEI Project Manager and the CHSO.

Alcohol and Drug Abuse Prevention

Alcohol and drugs will not be allowed on the work site. Project personnel under the influence of alcohol or drugs will not be allowed to enter the site.

Heath and Safety Plan Sign-Off

All GEI personnel conducting site activities must read the Heath and Safety Plan, be familiar with its requirements, and agree to its implementation.

Once the Heath and Safety Plan has been read, complete this sign-off sheet, and return it to the Project Manager.

Site Name:

MacDermid Incorporated

Investigation:

Environmental Investigation

GEI Project No: 073290*-1000

I have received and read the Heath and Safety Plan, been briefed on it, and agree to its implementation.

Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:

APPENDIX A

Attachment 1

Cold Stress Guidelines

	Symptoms	What to do
Mild Hypothermia	<ul style="list-style-type: none"> ▪ Body Temp 98-90°F ▪ Shivering ▪ Lack of coordination, stumbling, fumbling hands ▪ Slurred speech ▪ Memory loss ▪ Pale, cold skin 	<ul style="list-style-type: none"> ▪ Move to warm area ▪ Stay active ▪ Remove we clothes and replace with dry clothes of blankets ▪ Cover the head ▪ Drink warm (not hot) sugary drink
Moderate Hypothermia	<ul style="list-style-type: none"> ▪ Body temp 90-86°F ▪ Shivering stops ▪ Unable to walk or stand ▪ Confused irrational 	<ul style="list-style-type: none"> ▪ All of the above, plus: ▪ Call 911 ▪ Cover all extremities completely ▪ Place very warm objects, such as hot packs on the victim's head, neck, chest and groin
Severe Hypothermia	<ul style="list-style-type: none"> ▪ Body temp 86-78°F ▪ Severe muscle stiffness ▪ Very sleepy or unconscious ▪ Ice cold skin ▪ Death 	<ul style="list-style-type: none"> ▪ Call 911 ▪ Treat victim very gently ▪ Do not attempt to re-warm
Frostbite	<ul style="list-style-type: none"> ▪ Cold, tingling, stinging or aching feeling in the frostbitten area, followed by numbness ▪ Skin color turns red, then purple, then white or very pale skin ▪ Cold to the touch ▪ Blisters in severe cases 	<ul style="list-style-type: none"> ▪ Call 911 ▪ Don not rub the area ▪ Wrap in soft cloth ▪ If help is delayed, immerse in warm, not hot, water
Trench Foot	<ul style="list-style-type: none"> ▪ Tingling, itching or burning sensation ▪ Blisters 	<ul style="list-style-type: none"> ▪ Soak feet in warm water, then wrap with dry cloth bandages ▪ Drink a warm sugary drink

HEAT STRESS GUIDELINES

Form	Signs & Symptoms	Care	Prevention ³
Heat Rash	Tiny red vesicles in affected skin area. If the area is extensive, sweating can be impaired.	Apply mild lotions and cleanse the affected area.	Cool resting and sleeping areas to permit skin to dry between heat exposures
Heat Cramps	Spasm, muscular pain (cramps) in stomach area and extremities (arms and legs).	Provide replacement fluids with minerals (salt) such as Gatorade.	Adequate salt intake with meals ¹ ACCLIMATIZATION ²
Heat Exhaustion	Profuse sweating, cool (clammy) moist skin, dizziness, confusion, pale skin color, faint, rapid shallow breathing, headache, weakness, muscle cramps.	Remove from heat, sit or lie down, rest, replace lost water with electrolyte replacement fluids (water, Gatorade) take frequent sips of liquids in amounts greater than required to satisfy thirst.	ACCLIMATIZATION ² Adequate salt intake with meals ¹ only during early part of heat season. Ample water intake, frequently during the day
Heat Stroke	HOT <u>Dry</u> Skin. Sweating has stopped. Mental confusion, dizziness, nausea, severe headache, collapse, delirium, coma.	HEAT STROKE IS A MEDICAL EMERGENCY - Remove from heat. - COOL THE BODY AS RAPIDLY AS POSSIBLE by immersing in cold (or cool) water, or splash with water and fan. Call for Emergency Assistance. Observe for signs of shock.	ACCLIMATIZATION ² Initially moderate workload in heat (8 to 14 days). Monitor worker's activities.

Footnotes:

- 1.) American diets are normally high in salt, sufficient to aid acclimatization.

However, during the early part of the heat season, (May, June), one extra shake of salt during one to two meal per day may help, so long as this is permitted by your physician. Check with your personal physician.

- 2.) ACCLIMATIZATION - The process of adapting to heat is indicated by worker's ability to perform hot jobs less fluid loss, lower concentrations of salt loss in sweat, and a reduced core (body) temperature and heart rate.
- 3.) Method to Achieve Acclimatization - Moderate work or exercise in hot temperatures during early part of heat season. Adequate salt (mineral) and water intake. Gradually increasing work time in hot temperatures. Avoid alcohol. Normally takes 8 to 14 days to achieve acclimatization. Lost rapidly, if removed from strenuous work (or exercise) in hot temperature for more than approximately five days.

Appendix C

AOC B – UST Closure Report (Electronic Only)

Appendix D

AOC E2 – WWTS Closure Plan & CT DEP Acceptance Letter (Electronic Only)

Appendix E

AOC K1 – RCRA Closure Summary for Former Hazardous Waste Storage and Recycling Area & Closure Certification (Electronic Only)

Appendix F

AOC K2 – Closure Certification for the Former NMP Recycling Area (Electronic Only)

Appendix G

AOC K3 – Closure Certification for the Spent Solder Stripper Recycling Area (Electronic Only)